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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK GREAT BRITAIN NO. 413429

SEE PAGE 719

Pick Your Job - I'll Train You!

Eight Weeks in Either of my Schools and You step into the Big Pay Class

This Will Start You On The Road to Independence

Get out of the rut of underpaid, no advancement jobs—get into the auto game—the field of unlimited opportunities—of big pay—of independence. Thousands of jobs are open, paying from $150 to $500 a month on salaries—and the sky is the limit if you go into business for yourself.

McSweeny Trained Men Are In Demand

A man who has completed the course taught in either of my schools finds the doors of the automobile, tractor and battery businesses open to him. "McSweeny Trained" means a real job at real money. Thousands of my former students who now own their own business won't hire any but McSweeny trained men. They know!

$86,000 Made by a McSweeny Trained Man Last Year!

A. J. Beall, Jr., Morgantown, W. Va., made $86,000 last year with his garage and service station. Geo. W. Smith, W. Alexandria, O., makes over $800 a month. Thousands of others are making from $50 to $150 a week.

You Learn by Doing Actual Jobs

You can't learn any profession out of books, you can learn *why*, but never *how*. I teach you both the *why* and the *how* by doing actual jobs on the most modern equipment. That's why you can walk out of my schools into big paying jobs.

Aren't You Just as Good as They Are?

Would you admit to anyone, even to yourself, that these men are any brighter or cleverer than you? I know them—and I'll bet they aren't—the only difference is that they *know how*. Spend eight weeks in either of my two big schools and I'll teach you the same things that have made them big money makers.

Decide Today — Your Entire Future Lies in the Balance

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R. R. Fare and Board FREE

For a limited time only, I am offering a special low tuition rate, including Free R. R. Fare and Board. Get full particulars by sending coupon today.

EVEREADY
Radio Batteries
–they last longer

EVEREADY RADIO BATTERIES FOR EVERY RADIO USE

Each one supremely economical and efficient for the use for which it is designed—each one made under the supervision of the world's greatest electro-chemical battery laboratory

Eveready "B" Batteries

THERE are Eveready Batteries for portable sets where small size and light weight are more important than long life. There are Eveready medium size batteries that come between the small and the large sizes. There are Eveready large size "B" Batteries that afford maximum economy and reliability of service when used with average one, two, three or four tube sets. And now there is a newer Eveready heavy duty, extra large size "B" Battery that gives similar economy to owners of multi-tube heavy drain receiving sets and power amplifiers.

For maximum "B" Battery economy, buy Evereadys, choosing the large sizes (Nos. 766, 767, 772) for average home sets, and the heavy duty, extra large (No. 770) for multi-tube heavy drain receiving sets and power amplifiers. For portable sets choose the Eveready No. 764 medium size, unless space is very limited, in which case choose the Eveready No. 763 small size "B" Battery.

Eveready "C" Battery

Eveready makes a long-lasting "C" Battery with terminals at 1½, 3 and 4½ volts. May also be used as an "A" Battery in portable sets.

Eveready "A" Batteries

Eveready offers you "A" Batteries for all tubes, both storage and dry cell. For storage battery tubes, use the Eveready Storage "A." For dry cell tubes, use the Eveready Dry Cell Radio "A" Battery, especially built for radio use.

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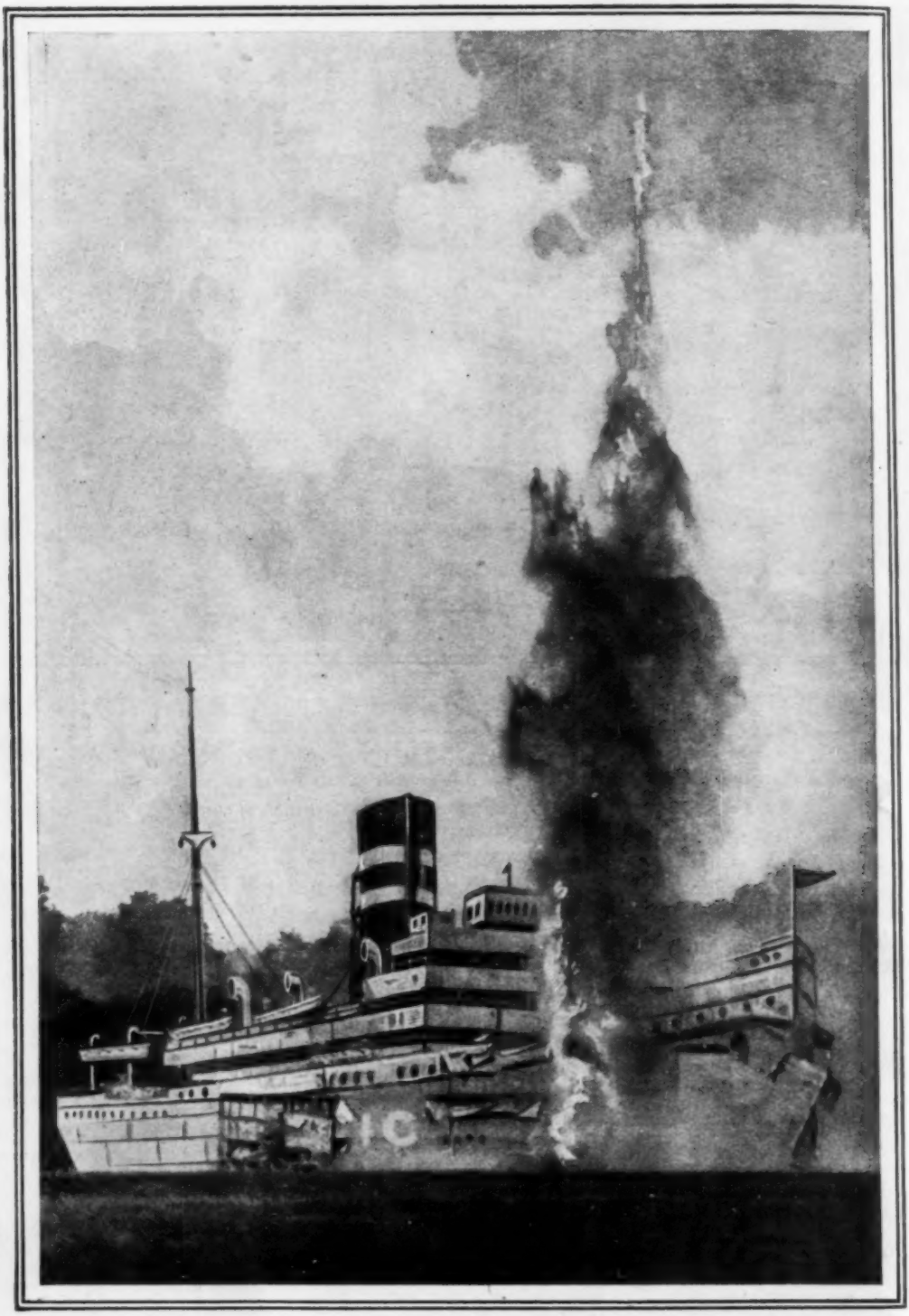

Aerial Bomb Finds Its Mark during Exhibition by British Air Force; the Imitation Naval Fight Was Staged on Land and This Target "Rode the Sea" in a Wide Meadow—See Page 810

Popular Mechanics Magazine
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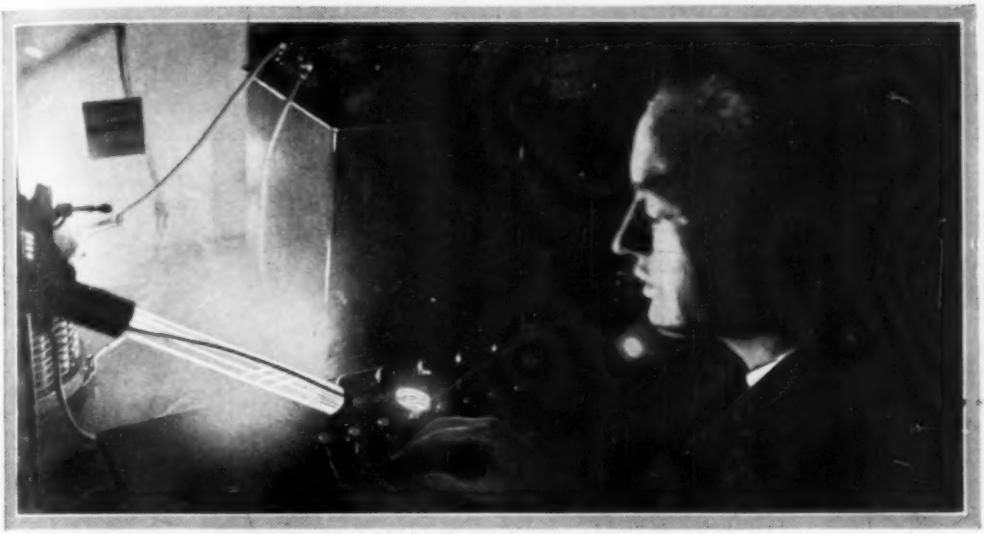
Vol. 42 NOVEMBER, 1924 No. 5



Shooting a 25,000-Volt Spark before the Eyes of a Motorist Alone in a Darkened Cabinet to Test His Nerve and Power of Self-Control

Mind Tests Given Automobile Drivers

Queer Instruments Are Designed to Reveal Judgment, Power of Self-Control and Reaction to Fear

SCIENTIFIC tests for the selection of automobile drivers and designed to eliminate the mentally unfit and the reckless man, have been perfected by Dr. A. J. Snow, consulting industrial psychologist for the National Association of Taxicab Owners.

These tests measure the prospective driver from three angles, intelligence, carefulness and reaction to sudden danger. After getting a job as a driver and operating a cab for some time to study his fellow drivers and their problems, Dr. Snow, who is a member of the department of psychology of Northwestern University, is now applying his tests to the 5,000 drivers of a large taxicab company. The secret of the "fear test," showing the driver's reaction to sudden danger, is closely guarded by Dr. Snow and his associates, in order to keep the drivers off guard when they take it. In the tests, the driver is cautioned to avoid certain things which, however, have no bearing on the result. This is to divert his mind from more important details.

A high-frequency machine, developing 25,000 volts and operating at several million cycles, is used. The driver being tested is placed before the machine in a tiny dark room. Two foot pedals on the floor correspond to the operating pedals of the car. The driver's left hand is placed on a telegraph key, which closes the circuit to a tiny red lamp on a switchboard in front of him.

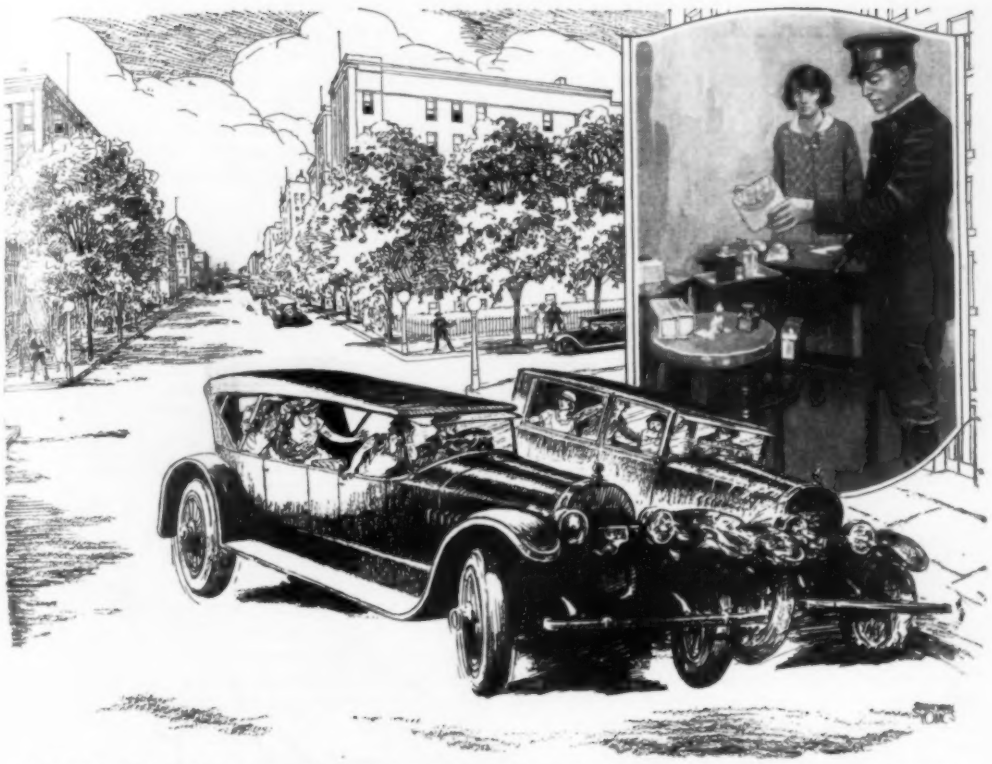
By the light of the small globe he is required to manipulate a series of wires, sticking the ends into binding posts and screwing down the tops to hold them. As each connection is made by the driver's right hand, another red globe lights and a tiny telltale light on the control board outside the booth flickers to record the

Timing the Chauffeur's Reactions at the Controls Outside the Dark Room, and an Emergency on Slippery Streets Where Quickness Wins

fact. The telltale burns only when the man in the test booth has both feet and hands in the places assigned. After a few seconds the operator outside turns a switch to the high-frequency machine and a brilliant blue spark leaps across a gap a few inches from the startled chauffeur's nose. Another and larger spark sputters within the glass-fronted cabinet of the machine and a third darts toward the hand resting on the telegraph key.

The driver is instructed when anything happens to startle him, to remove hand and feet from the controls, step on another pedal and turn a switch with his right hand. As soon as the pedal is depressed and the switch turned the electrical discharge stops. The operator outside, armed with a stop watch, records the time elapsing between the instant the test is started and the time the driver reacts properly. A written test is given to measure the applicant's intelligence, memory and capacity to observe things and follow simple directions. The test, patterned much along the lines of those given in the army during the war, requires twelve minutes and may be given to large classes of a hundred or more at a time or to individuals. "We eliminate persons of weak mentality at the start through this test," Dr. Snow explains. "The examination is simple, showing whether the man has a normal mentality, can follow simple directions, solve very simple problems, can adjust himself to new situations, whether he can learn simple things and whether he can pay attention when subjected to slight distractions." The test problems include simple exercises in dividing lines into specified groupings of equal or unequal parts; simple problems of arithmetic; a memory test in which pictures of a dozen objects, including a house, man, girl, dog, hand, etc., are exhibited for ten seconds and the driver is then required to write down the names of as many as he can remember.

The third part of the examination is unusual. Thirteen objects are placed, according to a carefully worked out scheme, on one table and the driver is instructed to transfer them to three smaller tables. One small table has a pan of water for a top, the second has a lighted candle in the center and the third is built with legs askew so that it will only sustain light weights. The test is designed to show the subject's intelligence in picking light ob-



A Fear Test Would Have Shown Whether These Drivers Could Keep Their Heads; Inset Shows Laboratory Assistant Giving Judgment Test to Taxicab Driver, Using Trick Tables

jects for the weak table, noncombustibles for the table with the candle and waterproof articles for the third. The objects used in the test include a bar of soap, a picture, book, lamp, pound box of butter, bottle of gasoline, a small can, box of eggs, bottle of ink, bottle of oil, sack of sugar, sack of flour and a small bottle. An additional test is being developed in which the driver is given a problem in choosing the quickest and safest route between two points. A large brass plate has been designed, with a starting point in the upper left-hand corner and a destination point in the lower right-hand section. Between the two run four curved and winding paths, cut through the brass. The first, and shortest path, is very narrow and each of the others is wider, the longest being the widest of all. Along the sides of the paths at intervals projections imitate other cars. The driver is given a brass pencil and told to trace the path by which he can reach the destination in the least time with the greatest safety. He is warned that each time his pencil touches the side of the path or one of the "cars" along the route he will receive an electrical shock and an automatic counter will record the "accident." An automatic clock likewise records the

Dr. Snow, the Inventor, Giving Fear Test to Driver, Showing Apparatus Outside of Dark Room

time of starting and the time of arrival. While the clock and counter are visible to the driver, most of the value of the test, according to Dr. Snow, lies in a moving roll of paper, which is passed under the plate by clockwork. The moving paper records the path of the pupil's pencil and, with the sheet advancing at a fixed speed, shows the time taken to traverse any section of the path.

"The applicant does not need to be an intellectual heavyweight to pass these tests," Dr. Snow says, "but he must be able to carry out simple directions, recognize objects under unusual conditions, learn simple things and have a normal memory. The person of very low intelligence is quickly discovered and eliminated.

"Intelligence, however, is not the only qualification for a safe driver. A man may have a very alert mind and at the same time be naturally careless or reckless. These two failings are largely a matter of nature and training—or rather lack of training.

"Even if a man is naturally careful he may lose his head in an emergency. To determine his presence of mind, he is told to operate the electrical board, which may give him an unexpected scare. The driver's quickness and steadiness under this test give an accurate estimate of his ability to meet the emergencies of modern street traffic. If a driver passes all three tests satisfactorily, he is presumed to be a safe and competent person to operate a taxicab. While these tests have not yet been developed to the stage where they can be considered infallible, results of experiments already conducted indicate their value. When the tests made of drivers for one company were checked against the accident records of these men, it was found they tallied in more than 90 per cent of all cases. Many changes in detail are being made in the tests before making them available for general use, but their correctness in principle has been established."

In addition to the special tests, Dr. Snow has also made an investigation of the accident records of 2,000 drivers to determine whether the fact that a man was single without dependents, married, or single with dependents, made any difference in his qualifications as a driver. The investigation disclosed that there was no difference in the records, upsetting the old belief that a married man was a steadier and more careful driver.

An investigation is now being made from the accident records of 5,000 drivers to determine whether the belief of the taxicab owners that men of certain races think more quickly and make better drivers than men of more stolid races is in fact true. It represents the first study into racial characteristics in relation to mental equipment of chauffeurs.

Chauffeurs Who Pass Psychological Tests Are Expected to Think Quickly in Emergencies, as When Street-Car Passenger Trips While Alighting and Falls in Front of the Taxicab

A Modern Version of the "Seven-League Boots"; Swift and Sturdy Three-Wheeled Roller Skates Being Demonstrated on Rough Side Hill, with and without Staves, by Enthusiastic German Sportsmen

Closer View of Side-Hill Jump Showing How Skates Are Attached, and Rubber Tires

Land Skates Run on Rough Ground and Rival Ski Jumpers' Feats

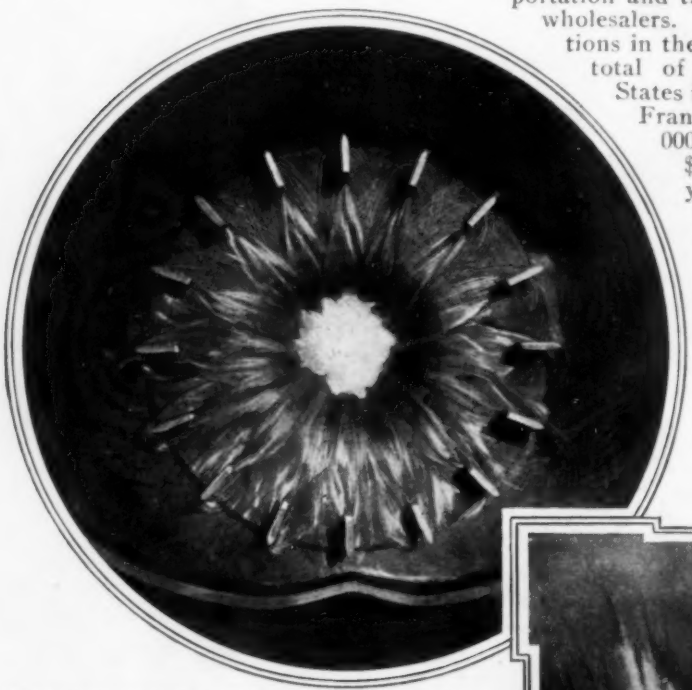
Feats that rival those of the ski jumpers or snowshoe devotees are said to be possible on a new style of roller skate being manufactured for sportsmen in Germany. They have a broad support for the foot and three rubber-tired wheels, two in front and one behind, and are said to be well adapted to traveling over rough ground, a speed of seven and one-half miles an hour on uneven surfaces being common and ten miles an hour on pavements easily achieved. Coasting on side hills and jumping either with or without staves are possible with the skates because of the ease with which they roll over rough country. The pair weighs about seven and one-half pounds.

Grub of Beetle Lives Thirty Years without Ever Growing Up

After living thirty years without undergoing transformation into an adult, the grub of an unknown species of beetle died recently in an English museum. For six years, the odd specimen had been kept in a pencil case, and been in the care of a special keeper with whom it had traveled nearly halfway around the world.

Eighty-Mile River Run into Funnel to Produce Electricity

Pouring the surplus water of the Deerfield river down a giant funnel, with a mouth 160 feet across and a twenty-two and one-half foot shaft below, has been accomplished at the Davis Bridge power development in Vermont. The Deerfield river, which is only eighty miles long, falls 2,000 feet, and the upper half, where the power plant is located, flows between high and narrow banks. An immense earth-fill dam was built, giving a power head of from 300 to 390 feet, but, because of the high walls and narrow channel, it was found difficult to locate a spillway. In building the dam, a diversion tunnel was constructed through the rock wall at one side of the river to carry the flow during construction. The engineers tapped this tunnel with a vertical shaft which culminated in the giant horn-shaped spillway studded with concrete pillars to break up formations of ice or other obstructions. The project develops 60,000 horsepower, has a reservoir capacity of five billion cubic feet and cost $10,000,000.



Model to Illustrate Water's Course Flowing into Funnel, and View of Actual Spillway

¶Of England's 42,000 doctors, only 2,000 are women.

World's Yearly Fish Catch Valued at About Billion Dollars

The fish catch of the world approximates a billion dollars a year in its cost to the final consumer, according to estimates. Twenty-five per cent of this amount is allotted to the cost of cold storage, transportation and the profits of retailers and wholesalers. Japan leads all other nations in the value of its catch with a total of $89,000,000; the United States is second with $86,000,000; France is third with $85,000,000, and Spain fourth with $72,000,000. Of recent years, there has been a large increase in the amount of capital invested in the industry. Since 1908, the total for the United States alone, exclusive of Alaska, rose from $38,000,000 to $60,000,000. Most of the world's fish supply comes from the shallow "banks" adjacent to the shores of the continents.

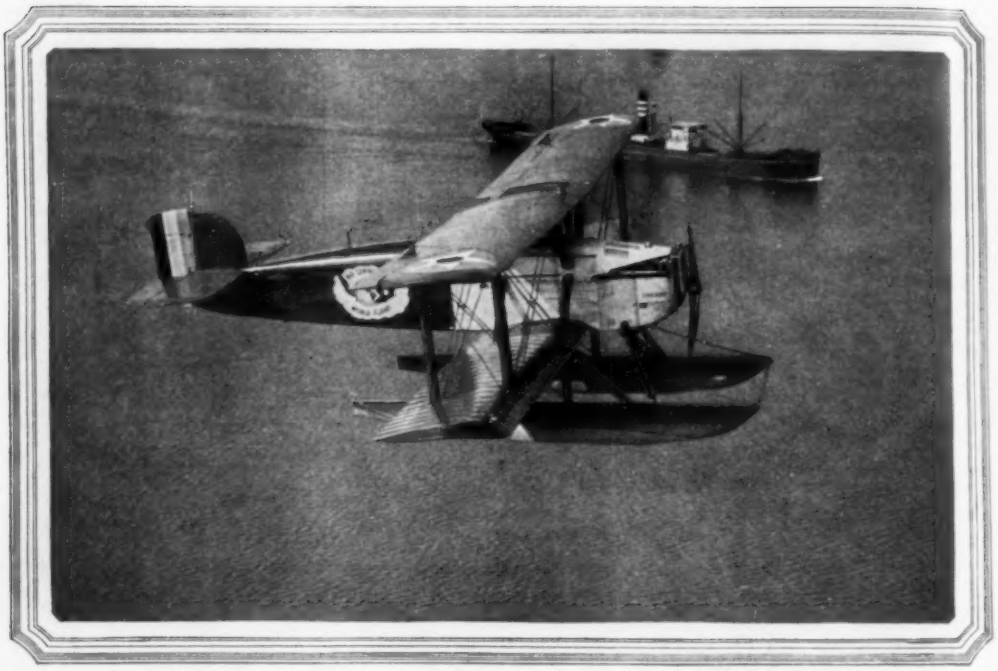
Pitching the One-Pole Tent for Convenient Shelter; Using It as a Buoyant Raft, and Its Appearance Folded on Back with Pole Serving as Walking Stick

One-Pole Tent Also Serves as Raft and May Be Carried on Back

A one-pole tent which looks like a greatly enlarged sleeping bag and which is not only easily carried on the back, but can be transformed into a raft by filling it with brushwood, is a Norwegian invention which is finding favor with English campers and hikers. Four pegs and a collapsible pole are all that is needed to erect the tent, which presents an unusual appearance because, like a sleeping bag, it goes under as well as over the occupant. Folded up, the canvas makes a light package for the back, and the collapsible pole can either be rolled inside, or used as a walking stick. When a stream is reached, a quantity of dry brushwood to fill the canvas will transform it into a raft.

Whites, Enslaved by Negro Tribe, Discovered in Depths of Africa

Slaves of an African chieftain and his followers, a company of about fifty white men and women, believed to be descendants of old Dutch pioneers who lost their way while trekking across the wilderness, have been reported by a British expedition at Molopolole, in the interior of the Kalahari desert in southern Africa. The unfortunates have no right to own property, are given no privileges and are virtually serfs of the natives, tilling the soil in return for small quantities of grain as wages. Chief Sebele, head of the tribe, was found to be fairly well educated and both he and his wife wore European clothes. The blacks carry rifles, but none of the whites are allowed to possess firearms.



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Pontoons Attached, the Gleaming "Chicago" Noses Northward over Puget Sound after Hopping Off from the Sand Point Flying Field at Seattle on April 6

Round World in Eight Days Next?

History-Making Journey Is Declared to Have Proved the Practicability of Air Transportation between Continents

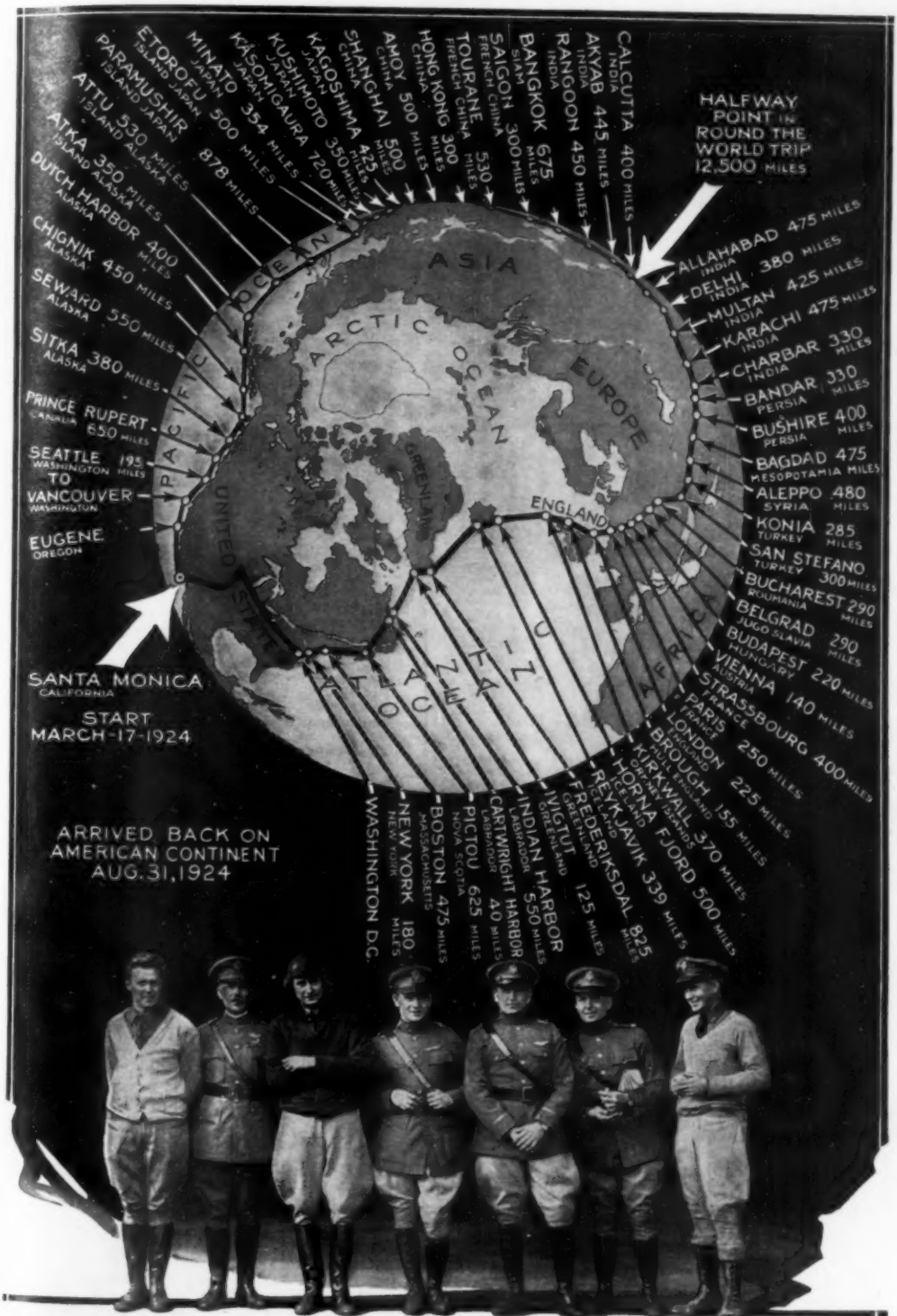
WITH the triumph of the American army fliers' effort to circumnavigate the world, greater developments in the realm of aviation are predicted for the next few years than in all of the twenty years that have passed since the Wright brothers first began, clumsily but miraculously, to skim over the Atlantic coast.

Sixteen-hour airplane service between New York and San Francisco and round-the-world passenger service in 170 hours, including a sixty-five-hour air route between Gotham and Pekin, China, are some of the developments which may be expected, according to Brig. Gen. William Mitchell.

In circling the globe, covering a distance of approximately 24,000 miles in less than six months, the army fliers are declared to have proved the practicability of air transportation between continents with the present type of craft, to have stimulated the adoption of planes for the needs of commerce and to have brought to the United States the great honor of being the first to accomplish this feat.

The flight of these modern Magellans was started March 17 from Clover field, Santa Monica, Calif., the squadron being made up as follows: "Seattle," flag plane, with Maj. Fred L. Martin as pilot and Sergt. Alva Harvey as mechanician; "Chicago," Lieut. Lowell H. Smith and Leslie P. Arnold; "Boston," Lieut. Leigh Wade and Lieut. H. M. Ogden; "New Orleans," Lieut. Eric Nelson and Lieut. John Harding, Jr.

On the first day the squadron hopped to Sacramento, covering 370 miles. The second leg was 550 miles to Seattle where the fliers arrived on March 20. From there the route led northward to Alaska where Maj. Martin was forced to abandon the race, having encountered engine trouble


HALFWAY POINT IN ROUND THE WORLD TRIP 12,500 MILES
CALCUTTA 400 MILES INDIA
AKYAB 445 MILES INDIA
RANGOON 450 MILES INDIA
BANGKOK 675 MILES SIAM
SAIGON 300 MILES FRENCH CHINA
TOURANE 530 MILES FRENCH CHINA
HONG KONG 300 MILES CHINA
AMOY 500 MILES CHINA
SHANGHAI 500 MILES CHINA
KAGOSHIMA 425 MILES JAPAN
KUSHIMOTO 350 MILES JAPAN
KASOMIGAURA 720 MILES JAPAN
MINATO 354 MILES JAPAN
ETOROFU 500 MILES ISLAND JAPAN
PARAMUSHIR 878 MILES ISLAND JAPAN
ATTU 530 MILES ISLAND ALASKA
ATKA 350 MILES ISLAND ALASKA
DUTCH HARBOR 400 MILES ALASKA
CHIGNIK 450 MILES ALASKA
SEWARD 550 MILES ALASKA
SITKA 380 MILES ALASKA
PRINCE RUPERT 650 MILES CANADA
SEATTLE 195 MILES WASHINGTON TO VANCOUVER WASHINGTON
EUGENE OREGON
SANTA MONICA CALIFORNIA START MARCH-17-1924
ARRIVED BACK ON AMERICAN CONTINENT AUG. 31, 1924
ALLAHABAD 475 MILES INDIA
DELHI 380 MILES INDIA
MULTAN 425 MILES INDIA
KARACHI 475 MILES INDIA
CHARBAR 330 MILES INDIA
BANDAR 330 MILES PERSIA
BUSHIRE 400 MILES PERSIA
BAGDAD 475 MILES MESOPOTAMIA
ALEPPO 480 MILES SYRIA
KONIA 285 MILES TURKEY
SAN STEFANO 300 MILES TURKEY
BUCHAREST 290 MILES ROUMANIA
BELGRAD 290 MILES JUGO SLAVIA
BUDAPEST 220 MILES HUNGARY
VIENNA 140 MILES AUSTRIA
STRASSBOURG 400 MILES FRANCE
PARIS 250 MILES FRANCE
LONDON 225 MILES ENGLAND
BROUGH 155 MILES HULL ENGLAND
KIRKWALL 370 MILES ORKNEY ISLANDS
HORNA FJORD 500 MILES
REYKJAVIK 339 MILES ICELAND
FREDERIKSDAL 825 MILES ICELAND
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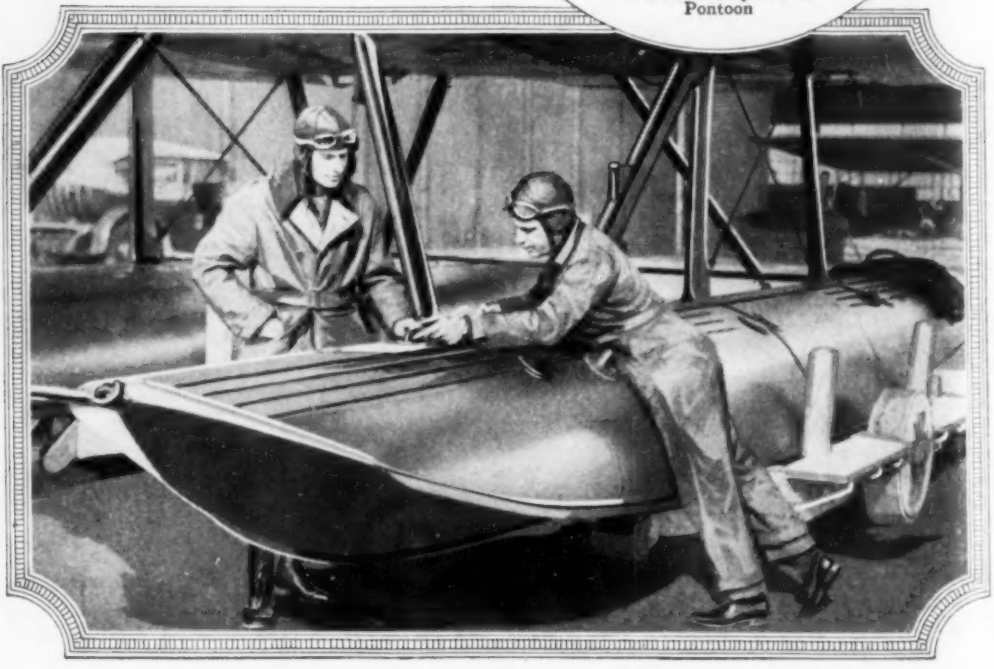
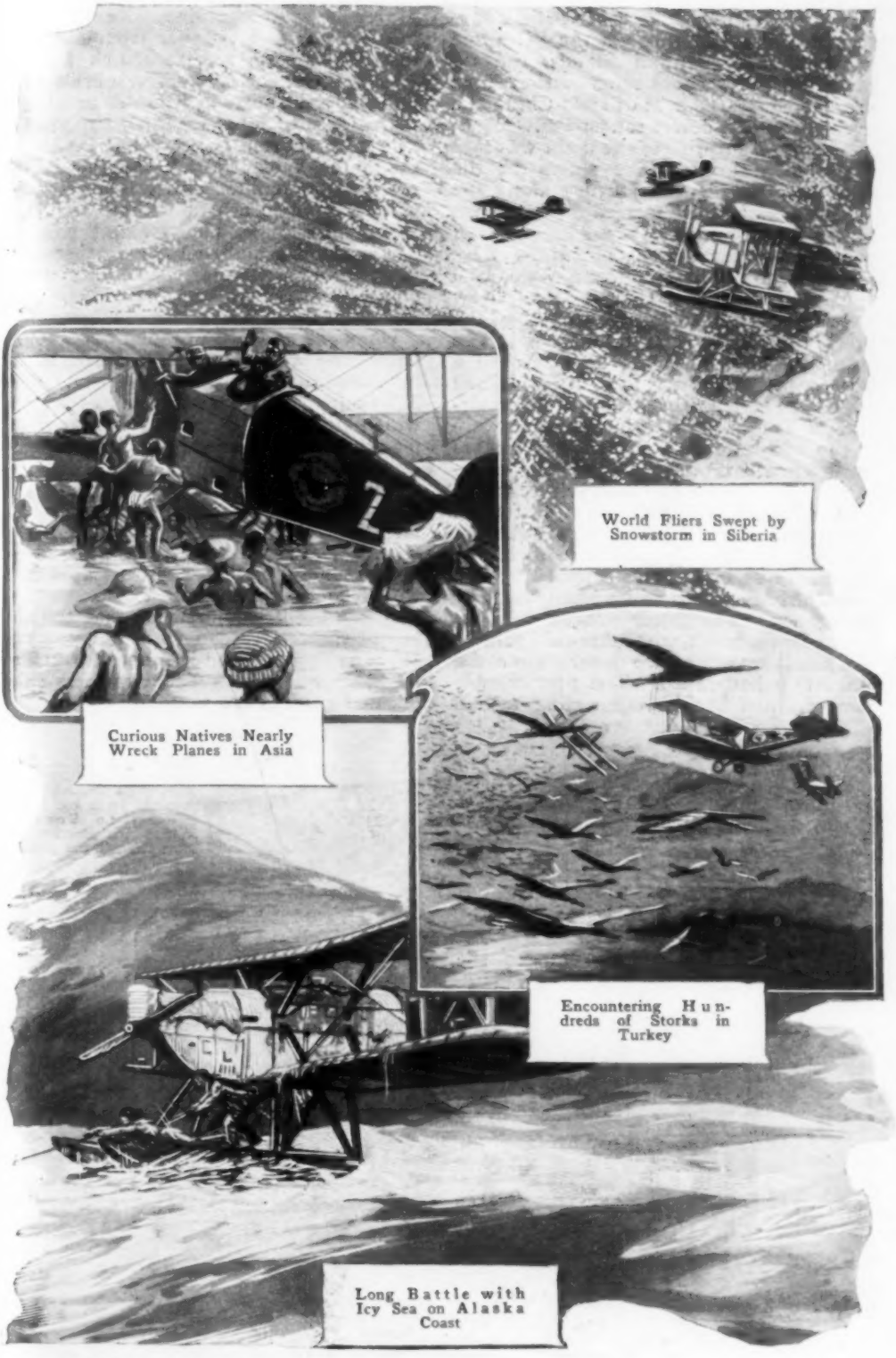
Trail of the Air Magellans, and Fliers Lieut. Harding, Gen. Mason Patrick, Who We'comed Their Return, Squadron Commander Lieut. Smith, and Lieuts. Wade, Ogden, Arnold and Nelson

Mechanics and Their Skill Were Important Factors in the Epoch-Making Flight for, by Frequent Overhaulings and Changing of the Engines, They Insured the Safety of the Planes So That They Would Not Fail the Fliers on Long and Arduous Tests; Maj. Davidson and Lieuts. Smith and Wade with Map, Point Out to an Interviewer Where a Thick Fog Stopped Them; Below, Lieuts. Schulze and Wade Inspect a Pontoon




World Fliers Swept by Snowstorm in Siberia
Curious Natives Nearly Wreck Planes in Asia
Encountering Hundreds of Storks in Turkey
Long Battle with Icy Sea on Alaska Coast

near Cape Igvak. The other planes continued their flight through the gales and snow of the Aleutian islands, the typhoons and torrential rains of the China sea, the equatorial heat of Indo-China and even through a desert sandstorm.

The great surprise of the flight was that the planes survived the rigors of the weather. During the journey along the Aleutian islands, ice formed on the wings several inches thick. It was chopped off and a few days later the wings were subjected to the heat of Japan, China and India, but when the "Chicago" and "New Orleans" ended the journey they had the same wings with which they started. The latter machine, however, had changed a lower panel in Burma after a native had rowed his sampan into the anchored airplane. The only big changes made were in the engines. Eighteen Liberty motors were placed around the world for emergency uses. These had been selected from a lot of seventy rebuilt ones in storage. They were of war-time vintage, but were the best available, producing 410 horsepower. The gasoline was supplied by two power-driven pumps and a handpump for emergency. The latter proved valuable across Davis Strait, when Arnold operated his handpump for two hours after the other two had failed. The first trouble came from a broken connecting rod in Major Martin's machine. Next, Wade's motor developed cylinder trouble and he installed a new one at Dutch Harbor, Alaska. Over the Sind desert a broken rod punched four holes in Nelson's crankcase.

En route to Japan, Smith's airplane developed a shorted battery. He landed on the water, fixed it in a few minutes, and rejoined the flight. This was the first repair ever made at sea with a continued flight following. The greatest troubles encountered, aside from the weather, were leaky cylinders, water, gasoline and oil-pump failures, broken connecting rods and one case of stripped motor gears.

Upon the arrival at the nation's capital, September 9, the flight had covered 22,874 miles and the airplanes had been in the air 320 hours and nineteen minutes, during which time they had consumed approximately 19,200 gallons of gasoline and 4,800 quarts of oil.

One of the chief lessons of the flight was the need for better communication facilities. Radio weather reports covering large areas would make such a flight safe and radio direction-control apparatus would conquer the densest fog.

It has been demonstrated that the airplanes themselves can withstand the rigors of such a trip and the motors will also stand up, but more reliable and less complicated engines are needed.

Maj. Ira A. Rader, Chief of the Information Division, Who Received First Reports from the Fliers, Pointing to Section Where Ice Barriers Almost Halted the Journey

Above, Lieut. Erik Nelson's Plane at Dutch Harbor, Unalaska, Where the Three Ships, after Maj. Martin's Accident, Resumed Flight for Atka Island, One of the Stepping Stones across the Bering Sea with Lieut. Nelson in Command of the Fleet; Center, Lieut. Smith and Two of the French Officers Who Greeted the Fliers in Paris; Below, a Pause in the Flight Shows the Size of the Fuselage of One of the Planes Emblazoned with Its Decorative Emblem

Loops at Street Crossings to Speed Traffic and Avoid Wrecks

Enabling vehicles to turn in any direction or to cross a street without cutting the path of other traffic or slowing up for

Designer and Model of Street Intersection with Looped Roads at Side for Turning

intersections, an arrangement that does away with right-angle junctions of roadways has a two-plane crossing. If drivers wish to turn off the highway in either direction, looped roads that circle each corner permit them to make the change without traveling against other traffic, and progress straight ahead can be maintained without being, as a rule, forced to reduce speed while passing a street. The system, it is said, is designed to increase movement on much-used thoroughfares and to eliminate the meeting of cars that run in opposite directions.

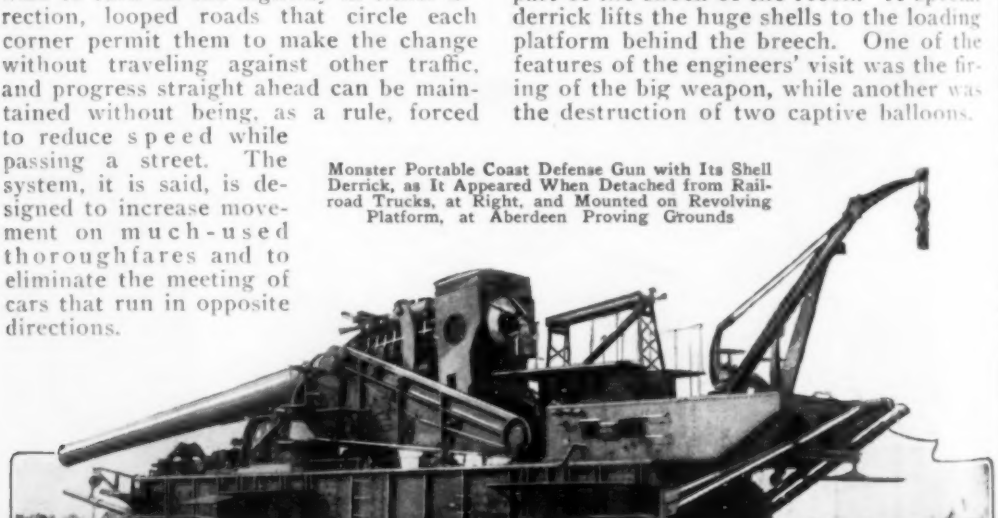
Lime and Sawdust Building Blocks Resist Fire, Sound and Moisture

Building blocks made of lime and sawdust, which engineers believe may revolutionize present methods of fireproof construction, are being manufactured at an eastern research plant. It is claimed that they not only resist intense heat but also are sound and moisture-proof, can be sawed, eliminate the need of lath for plastering and can be used for roofs as well as for walls. To the lime and sawdust or other wood fiber, ashes, sand or fine limestone is added, and the mixture is treated in such a way as to prevent the lime from carbonating. The bricks, in a few days, become uniformly hard and crystalline.

Monster Gun Has Removable Trucks for Use over Railroads

Uncle Sam's biggest movable gun was inspected by the American Society of military engineers when they visited the Aberdeen, Md., proving grounds to see the new sixteen-inch weapon, and other cannon, in action. The railway gun is equipped with detachable trucks, which are removed after it is placed on its revolving platform. Steel braces at either end of the car may be lowered to take up part of the shock of the recoil. A special derrick lifts the huge shells to the loading platform behind the breech. One of the features of the engineers' visit was the firing of the big weapon, while another was the destruction of two captive balloons.

Monster Portable Coast Defense Gun with Its Shell Derrick, as It Appeared When Detached from Railroad Trucks, at Right, and Mounted on Revolving Platform, at Aberdeen Proving Grounds



Skimming across Snow-Dusted Ice behind a Roaring Airplane, a Daring Tobogganer Tastes the Joys and Hazards of Winter "Surf Riding" in the Crisp, Biting Air

Airplane Toboggan Rides Yield Thrills for Winter Sportsmen

"Skikjoring," a novel joy ride for those who care to risk life and limb on the ice in the wake of a speeding airplane, is proving an exciting sport for visitors at Lake Tremblant, near Montreal. It is the winter form of surf riding. The airplane, equipped with broad runners for landing, zooms close to the snow-covered surface of the lake. Clinging to ropes attached to the wings, the "skikjorer," perilously standing on a toboggan or balancing himself on skis, bounds and sways in the rear as the ship approaches a seventy-mile-an-hour speed. The tang of the keen air is intensified by the blast from the propeller and as the motor roars, the gritty rider, fighting to avoid a spill, finds ample chance to test his nerve and dexterity, while the aviator must also exercise skill.

Golf Club with Adjustable Head Takes Place of Bagful

To eliminate the carrying of a heavy bag of clubs while playing a game of golf, a stick has been devised with a changeable head that can be adjusted for almost any stroke. The blade may be set in a few seconds at an angle to loft the ball in long drives or to propel it in a straight line along the level of the green. Graduated marks on the socket of the shank, into which the head fits, indicate the various positions at which the "pitch" of the iron can be put, and the joint is arranged to prevent clogging by dirt and grass. It is claimed that when using the single club for entire games, a player can greatly improve his accuracy since he need not suit his swing to various weights for different

Adjustable Golf-Club Head Showing Socket Which Is Marked to Indicate Proper Positions

strokes. The employment of the changeable stick also does away with the services of a caddy.

Small Three-Wheeled Auto Runs Eighty Miles on Gallon of Gas

Many of the comforts of a large roadster or touring car are found in a single-passenger, three-wheeled runabout made

Well Suited to Women Drivers, the Little Runabout Is Practical for Visiting and Shopping

in England. Designed on graceful lines, with folding top and windshield, the little vehicle is run by a two and three-quarters horsepower gasoline motor, applying power to the rear wheel through a chain and two sprockets, to which are attached two cork-faced friction wheels for high and low gear. The power plant, a single assembly, can be entirely removed in a short time and is so slung as to minimize road vibrations. Luxuriously upholstered, the car is capable of a speed of more than twenty miles an hour. Economical and easy to operate, it will run eighty miles on a gallon of gasoline, it is claimed, and the car is so light that an able-bodied man can easily lift it clear of the ground.

"Wool" Made of Pine-Tree Leaves Rivals Natural Product

By chemically treating the long, slender spines of the Scotch fir, German scientists have found a way to manufacture a substance which is said to have many of the qualities of natural wool. It can be curled, felted and spun or woven into carpets, and, mixed with a canvas warp, makes excellent blankets. The coarser qualities are used for stuffing mattresses and have been found proof against insects, while the aromatic odor is said to be agreeable and beneficial to patients. Large plantations of the trees are being cultivated. The leaves are gathered every second year while they are still green, and in such a way that the growth of the trees is not injured. The resinous substance in them is dissolved by boiling and with chemicals, leaving the fibers, which are easily separated and cleansed of all foreign matter. A woolly substance is left, the best quality of which can be spun into threads, like that of hemp and almost as strong. One of the by-products of the process is a valuable oil which can be used in the manufacture of varnish and perfumes and for dissolving rubber. This oil is said to differ greatly from the ordinary turpentine.

Pitless Organ Raised into View by Motor-Operated Screws

Quickly raised to any desired position on large worm screws concealed in posts at the corners, a pipe organ for theaters has been designed that requires no pit or hydraulic lifting jacks. It rests nearly flush with the floor and when power is applied from a central motor, player and organ rise before the eyes of the audience. Reversing the switch causes them to sink to the level of the orchestra pit. When the organ is lowered, the screws are hidden in the hollow posts that form part of

Player and Organ Lifted into View on Worm Screws Concealed in Corner Posts

the decorations. Greater compactness and decreased installation cost are claimed for this arrangement.

Barge Boxing Bout at Its Height and Close-Up to Show Position of Gloves

Boxing Gloves on Ends of Sticks Provide Thrill for Sailors

Sailors stationed at Goat island, on the Pacific coast, have developed a novel form of boxing to while away their leisure hours. The gloves are laced upon short sticks which are held behind the back and between the arms. Sides are chosen and at a signal, the opposing teams, using a floating barge as the ring, engage in a combination wrestling, boxing and pushing contest. A forced header into the sea scores a knockout blow for the "gob" who delivered the wallop, and always brings shouts from the delighted spectators who have "ring-side seats."

Sahara to Be Bridged by Railroad Two Thousand Miles Long

Already conquered by the camel and the motor car, the Sahara desert will be traversed by fast passenger and freight trains, if plans being made by French engineers to bridge the shifting sands with a railroad are successful. The line will be 2,000 miles long and will extend from the Algerian port of Oran to Wagadugu in the French Sudan, the capital of the fertile Upper Volta region, and conveniently situated for the establishment of a center to link up the Niger colonies. Seven years will be required to complete the work.

Volcano to Be Tapped to Get Steam from Nature's Boilers

Plans are under way to pierce the sides of Mount Tatio, an active volcano on the west coast of South America, to get the steam generated by the natural fires beneath the mountain. Most of the energy will be piped out for use in making electricity. Estimates show that as much current can be produced in this manner each year as would require the consumption of a half million tons of coal in an ordinary plant. It is said the steam is so pure that it can be run directly into turbine engines without the usual costly cleaning processes. In Italy thousands of horsepower have been developed in this way.

A Night Run with the Gotham Limited

How Nation's Fastest Trains Are Protected on Runs and Guided through Busy Terminals

SURROUNDED by loud-speaking telephones, telegraph instruments and electric lights, the train director in the interlocking tower is a commanding general who is in constant touch with every movement in the gigantic railway terminals developed to meet the constantly increasing demands of modern transportation. Before him is a long case, covered with frosted glass, on which is outlined the entire track and switch layout of the territory under his command. It is drawn to scale and little lights tell the condition of each track, whether it is occupied or vacant. Under his command are many men who manipulate the 400 levers that operate the switches and signals.

To put the average train onto its track in a big station requires the movement of from twenty to sixty levers. At one terminal there are 238 different points and crossings, 570 signals and 1,200 train movements on 113 tracks every railroad day. And yet the lever men handle this traffic without seeing the tracks or the trains on them. "No. 54 ready," is the word that reaches the tower after the station gates have closed behind the last passenger.

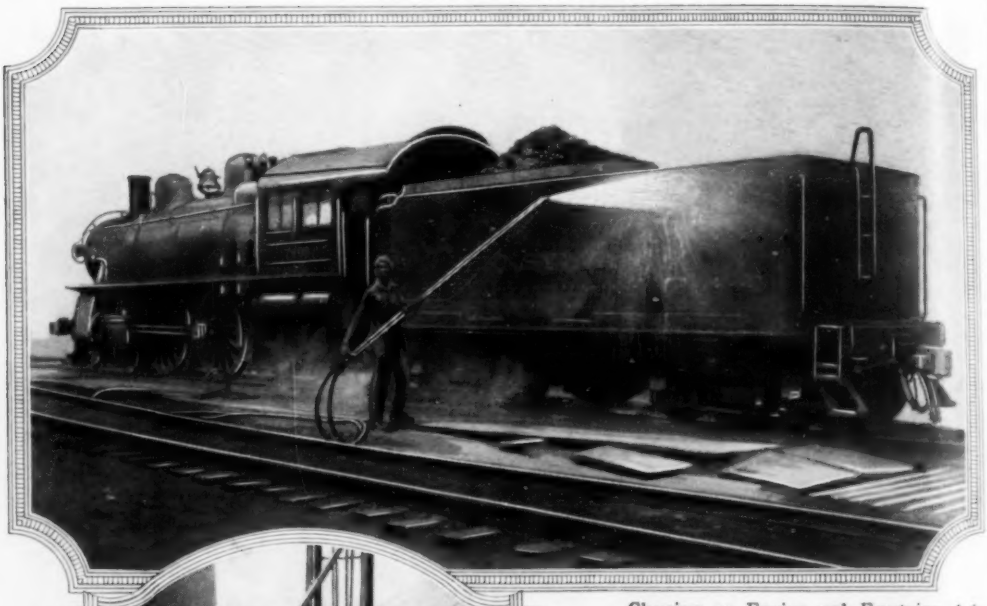
"Put 'er on track twenty," the train director orders and, as the levers are set, the signals flash along the bewildering maze of tracks in the yard before the eyes of the engineer waiting with his hand on the throttle. The conductor swings aboard one of the coaches and pulls the signal cord twice.

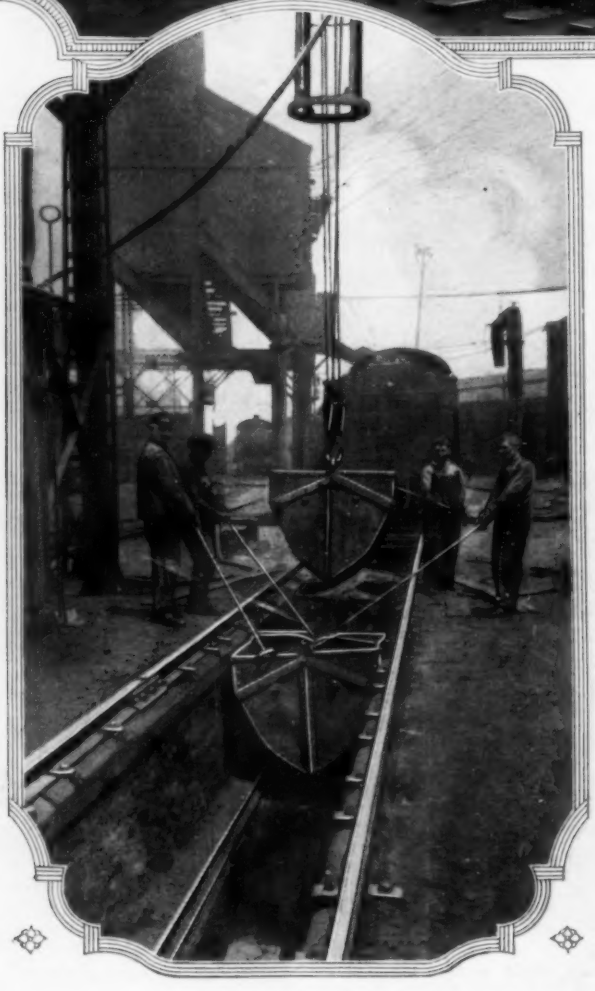
Two short, singing squeaks of the little air whistle in the cab interrupt the pounding of the air pump, the engineer tugs gently on the throttle, the eighty-inch drivers move and the Gotham limited rolls forward on the first leg of its 908-mile journey from Chicago to New York.

As the train swings under the last of the terminal viaducts, the fireman catches the gleam from a lantern swung high over the head of a switchman and shouts across to the engineer:

"Highball," the railway code for a clear track in answer to an arm or lantern sig-

Flying Down the Track into a Dumb, Dark World or across Sunny Plains, the Fear of Grade-Crossing Accidents Keeps Enginemen Always on the Alert





Cleaning an Engine and Emptying Ash-Pit Boxes

nal, and Engine 5353's whistle answers with two short blasts. As the train picks up speed, the engineer, a keen-eyed, gray-haired, bulky figure of a man who, in different garb, might be taken for a banker or corporation head, spies a green light burning over a red one at the approach to a bridge.

"Clear block," he shouts to the fireman who echoes back the call as the train roars past the gloomy network of girders, flying down the track into a dumb, dark world.

Above, the stars are blotted out by a black ribbon of smoke. Behind, the bunched electrics in the coaches are blinking out. In the cab, the needles of the dials flicker to and fro, cinders rattle on the roof and the rails begin to hum as the 250-ton racing locomotive settles down to its work.

Every three miles or so the fireman takes his eyes from the track ahead long enough to tend his fire—a white-hot blast that leaps and curls under the crown sheet. It is a constant battle to keep the gauge between 190 and 205 pounds' pressure. To maintain an average speed of forty-five miles an hour requires from

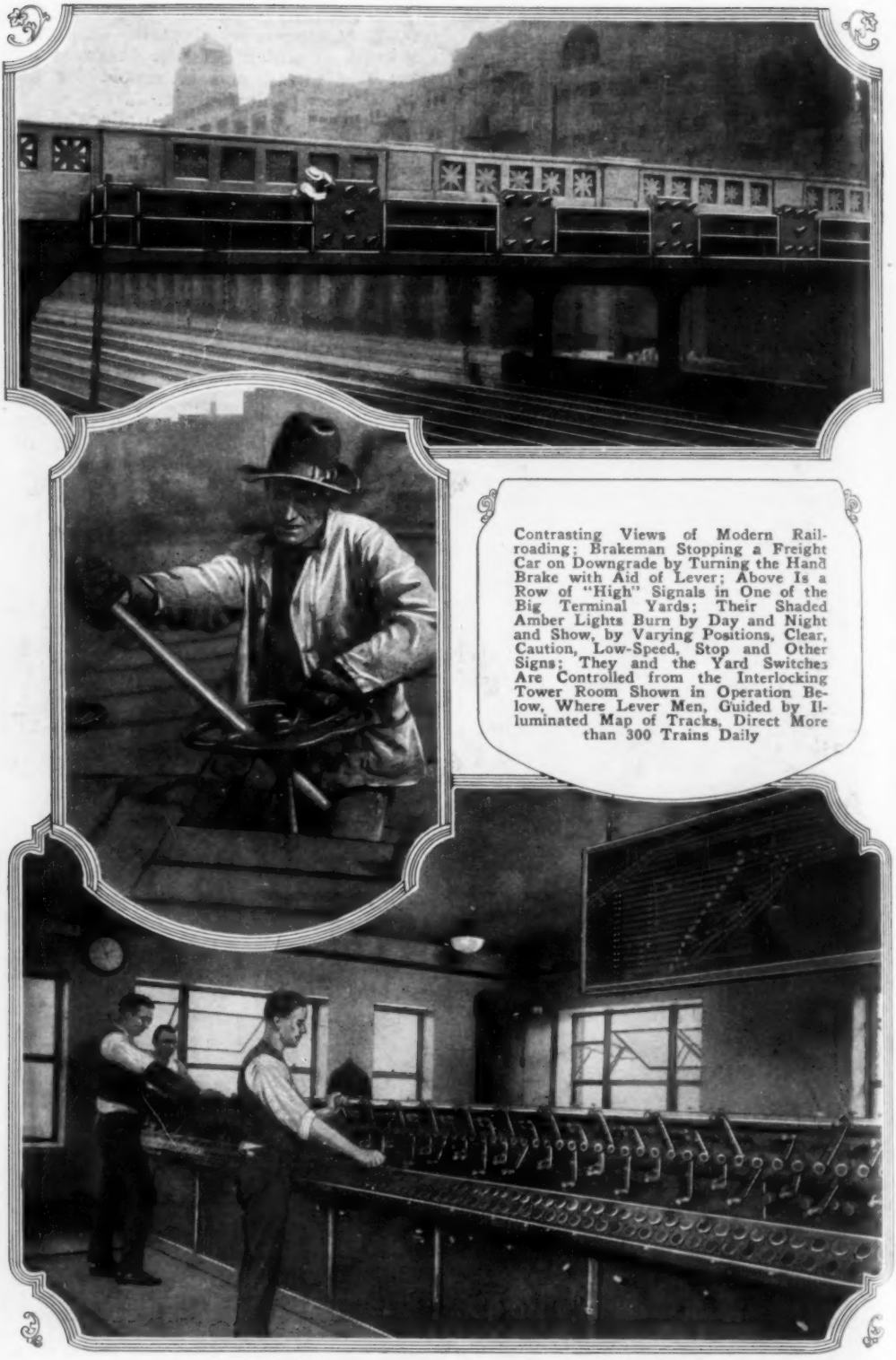
seventy to eighty tons of fuel in the 900-mile run.

So that the flames will not scorch his hands, the fireman skillfully lets the edge of his shovel graze the bottom of the door, sending the coal evenly over the seething surface where the flames are fanned by a powerful blower. In front of the speeding engine, the rails glisten in the glare of the 900,000-candlepower electric headlight, the beam of which cuts the darkness for 1,000 feet ahead and is visible for fifteen miles on a clear night.

The train is now running under the advance lighting system, which means that as it passes into each block the lights at the entrance of the one ahead flash out of the darkness. A "clear" signal shows that the track is open for at least two blocks ahead, giving the train two miles of unrestricted running. A caution signal is always set a mile ahead of a closed block so that only in case of an emergency is a train brought to a sudden stop.

One of the Pennsylvania's stringent rules is that the engineer and fireman verbally repeat the signals. This is an extra precaution to insure that both are on the alert and to prevent any mishap should

Coaling Pennsylvania Engines from an Eighty-Ton Capacity Electrically Filled Chute That Dumps on a Tender a Load of Four Tons in Two Minutes



Contrasting Views of Modern Railroading; Brakeman Stopping a Freight Car on Downgrade by Turning the Hand Brake with Aid of Lever; Above Is a Row of "High" Signals in One of the Big Terminal Yards; Their Shaded Amber Lights Burn by Day and Night and Show, by Varying Positions, Clear, Caution, Low-Speed, Stop and Other Signs; They and the Yard Switches Are Controlled from the Interlocking Tower Room Shown in Operation Below, Where Lever Men, Guided by Illuminated Map of Tracks, Direct More than 300 Trains Daily

Center Photo, Copyright, Ewing Galloway

Beside the White-Hot Blast That Leaps and Curls and Foams at the Crown Sheet, the Engineer of the Big Racing Locomotive Keeps Ceaseless Vigil

Hundreds of Men the Passengers Rarely See Are Constantly at Work on Railroad Switching Apparatus and Tracks to Insure Their Safety, as Are the Signal-Battery Inspectors Shown Above and Below; Making His Rounds Day after Day, the Track Walker, by Detecting Faulty Rails, Loose Joints and Ties, Is Often the Unsung Hero Who Prevents Serious Accidents

Left and Lower Photos, Copyright, Ewing Galloway

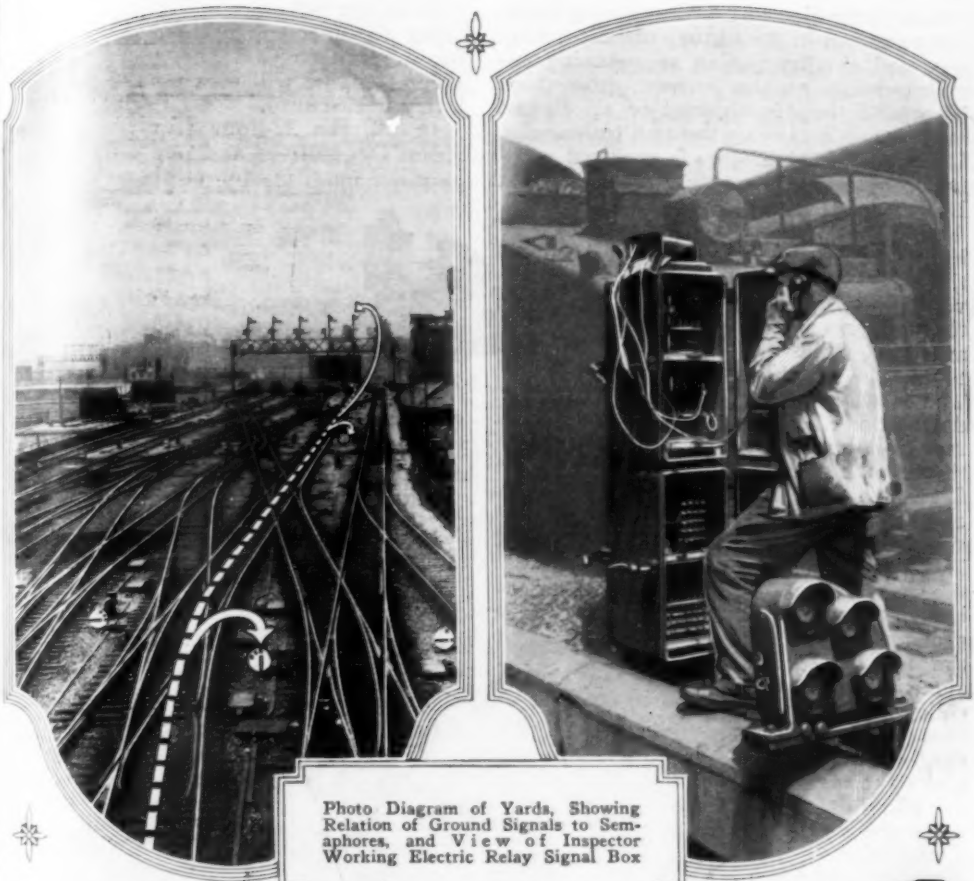
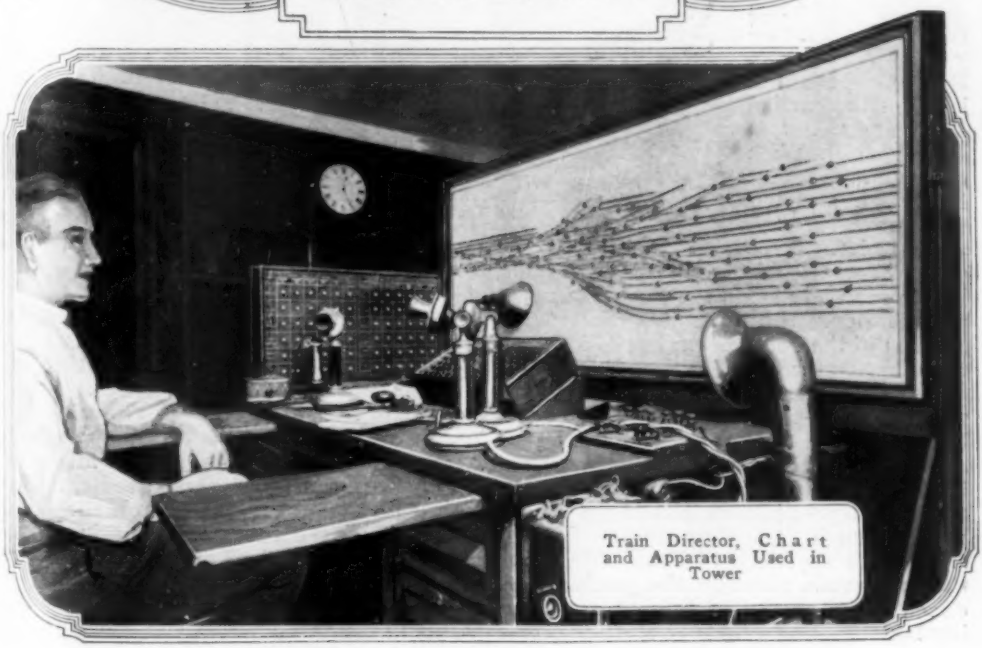


Photo Diagram of Yards, Showing Relation of Ground Signals to Semaphores, and View of Inspector Working Electric Relay Signal Box



Train Director, Chart and Apparatus Used in Tower

the engineer die at his post—a thing that is not unknown in the history of railroading.

Ahead, the light of an approaching engine twinkles on the horizon, grows to a blaze and then is dimmed to an almost imperceptible glow as the two trains pass. Dimming the headlights is required of all trains passing each other at night. At Davis, Ind., two dark slits appear between the rails, the 900-foot reservoirs from which the tender tanks are filled while the train is running. The Gotham slows down to thirty miles an hour and the fireman opens a flat door in the side of the tender and exposes a small lever. At a blast of the whistle, he pulls it, lowering a grooved tongue. As the train speeds along some 6,000 gallons of water shoot up the trough and into the engine tank, the overflow cascading down the sides of the tender, a reminder of the fact that it was less than a hundred years ago that Peter Cooper's first locomotive carried its water in two apple barrels. With the hum of giant bees the swaying cars move through the night. The wind roars past with the sweep of a gale. In the cab there is a dizzy clatter of noise, the occasional throb of the air pump and the hiss of the boiler cocks as the engineer tests his water level.

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Another Guardian of the Traveling Public's Safety, a Semaphore Signal Repair Man at Work

Above all the din comes the scream of the whistle—two long and two short blasts for the deadly grade crossing and a single note to warn the busy mail clerks in the cars behind to put out the arm for "snatch bags" that are picked up on the run. Soon a dull glow on the horizon signals the approach to Fort Wayne and the train rolls through the yards at reduced speed to the beckoning of swinging lanterns, and grinds to a stop, having covered the 148 miles in 198 minutes. Another engineer and fireman climb aboard for the run to Crestline, Ohio, where a second engine will pick up the train and hurry it eastward.

In all, the 22-hour trip requires five steam locomotives and one electric. Superintendents, master mechanics, enginemen, dispatchers, hostlers, wipers, crossing guards and track walkers watch constantly over its safety. At every stop clinking hammers try the wheels and the air-brakes are tested. A glance at one of the four gauges in the cab shows that the train is carrying 110 pounds of air for actual operation of the brakes in running and a red arrow on the same dial indicates 140 pounds for use in case the emergency brakes are applied. The steam gauge shows a boiler pressure of nearly 205 pounds at the time of departure. A third dial tells how much steam is being sent back to heat the train and a fourth shows how much pressure is used on the engine brakes when operated independently of the train. The throttle and whistle cord are at the engineer's left hand. The reverse lever is in front of him and the air-brake levers, a big brass handle set below a smaller one for controlling the engine alone, at the left. Three boiler cocks are at different levels high up toward the top of the cab. The glass water gauge shakes as the engine sways and is considered only a "fifty-fifty" indication of the boiler's contents, so that the chief reliance is placed on the cocks.

Opening the cocks is a certain way of measuring. By the sound of the outrushing mixture, the engineer can easily tell if dry steam is escaping where water should be. He endeavors to keep the

boiler filled just above the middle cock. This insures against too wet steam and water getting into the cylinders, cuts down on coal consumption and increases general efficiency.

Starting smoothly and without slipping or shaking the fire to pieces, stopping with a fine stream of sand running under the drivers to insure a firm hold for the wheels when the train starts again, keeping a speed that will fulfill the requirements of the schedule and get the most out of the coal and the engine and not cause the fireman useless labor are other points that are mastered only after years of experience. Making up the limited and getting it into the terminal before the engine is hooked on is the task of the yardmaster and his helpers. The Broadway limited normally consists of eight cars and the engine and tender. Once assembled, the train is generally kept intact as much as possible, although last minute orders may be received for an additional car or two to handle heavy traffic. If so, the yardmaster is informed and issues the required orders for alterations or additions to the train's equipment. In general, the yards are laid out so that the stubs from the main leads contain cars that have been switched and stored away according to their class so that they can be picked out and hooked to the train with a minimum loss of time.

Every car in the train has been subjected to a rigid inspection and cleaning and the engine itself, as part of the roundhouse routine, has been washed thoroughly with an emulsion of steam and oil, shot from a double-nozzled hose under ninety pounds' pressure. The blast rids all parts of the jacket, pistons and wheels of accumulated oil and dust and with a little wiping leaves the engine free from grime and rust. With this apparatus, two men can easily clean from twelve to fourteen engines a day. Under constant inspections and frequent repairings an engine will last thirty years and more. Its life largely depends upon the

Upper Photo Copyright, Ewing Galloway

From Their Offices, Cool Dispatchers, by Orders Spoken through Selective Telephones, Keep Main-Line Traffic Moving on Their Divisions and Guide Trains Safely into Busy Terminals

boiler, the vital part of the whole mechanism. Physical examinations of the engineer and firemen are conducted yearly after the men are past forty years old and they are constantly kept on the alert for the chance visit of an inspector.

When the train pulls out, its entire passage through the terminal is marked on a chart by the little green lights set at intervals along the pattern of the actual course of the track so that the lever men may follow the train's procedure through the area and set the signals properly as directed by other lights that flash below the lever handles. As the train puffs along past the switchtenders' stations, word of its passage is relayed by telephone from each station to the next one in advance. The dispatcher receives no report of it until it is outside the yards when it comes under his supervision.

"Alton Junction—No. 54—8:18" is the cryptic message the dispatcher receives. This gives him the name of the station calling, the number of the train and the time that it passed. He enters this information on his daily report of the train movements kept on a huge closely ruled sheet lying on the desk in front of him.

Similar messages come in as the train flashes by other stations. The dispatcher is the czar of all train movements in so far as they affect the main tracks on his division. In his mind he has a picture of every foot of track and siding in his territory; he knows just how long a train can be accommodated in a certain block; he knows the running time and class of every train and is also able to judge almost to the second just how fast any engineer could get his train to the next point in case of emergency, a bit of strategy being necessary frequently and aided in successful operation by the fact that the names of the train crew also have been entered on the report sheet. His work is done entirely by telephone, the telegraph conveniently installed on his desk being used only when the telephone breaks down. Before him is a selective switchboard on which by the turn of a key he can call any one of the stations under his supervision. His wire is directly connected to each of the stations and they in turn have separate connections to each other.

Although today there are 375,000 miles of rails in the United States, carrying the lifeblood of commerce to the ends of the nation, in 1830 there were only twenty-three miles. What has been accomplished has been the result of the skill and genius of one of the nation's greatest industries.

According to veteran railway men, however, the day of the steam locomotive is passing and the shadow of the giant electric engine is on the rails.

When Every Safeguard Human Ingenuity Has Devised Fails, and Wrecks Occur, Wrecking Cars and Powerful Cranes Quickly Clear the Tracks and Raise the Fallen Giants of the Rails

Lee's Statue on Mountain So Big Twenty Could Sit on Hat

So large are the figures being carved for the Confederate memorial in the granite side of Stone Mountain, in Georgia, that on the hat brim of the statue of General Robert E. Lee, the center of the group, twenty people could be comfortably seated. The excavation between two of the heads of the statues is seventy feet high, sixty feet wide and seventeen feet deep. With only a small part of the sculpturing accomplished, fifty-five carloads of stone have been cut out already. The work is laid out to be carried on from the top downward, the legs of the horses on which the figures are seated being the last to be finished. The heads of the characters each cover an area of almost thirty square feet, while the animals' heads measure fifty feet from ear tip to nostril. Along the neck of one of the horses, a large banquet table and 120 people could be easily accommodated. The task is said to require three years to complete.

Ship Built on Land Is Movie Theater and Bathhouse Combined

Built in the form of a ship, a structure at Portsmouth, N. H., has wide sun decks and serves as a movie theater and bathhouse combined. It is 150 feet long and lies close to the water's edge. The lower sections are devoted to accommodations for those partaking in water sports, while the upper part is arranged with awnings and chairs where guests may lounge or promenade on deck. The inclosed auditorium also can be used for the staging of theatricals and similar purposes. Motion-picture shows are held regularly for entertainment of the visitors.

Ship-Shaped Bathhouse and Movie Theater Combined Where Guests of Resort May Lounge on Shaded Decks Overlooking Sea

Toy Figure of Policeman on Auto Serves as Traffic Signal

Fitting over the auto taillight, a stop-signal device modeled after a traffic policeman, has been placed on the market by a western company. Movements of the arms of the figure indicate stops and right or left turns and are easily controlled from the dashboard of the car. The model is about a foot high, and is finished in blue, to match the regulation police attire, or may be had in aluminum. Signals are plainly visible to motorists in the rear and the device is easily installed.

Air Mail Rushes Asbestos Suits to Oil-Fire Fighters

Asbestos suits for the use of fire fighters combating a burning gas well near Cheyenne, Wyo., were rushed to the scene by air mail planes. Manufactured on an emergency order at the rate of one a day, each garment was sent to the postal flying field as soon as finished, and started on its way, traversing the entire length of the night-flight zone of the cross-continent route. Delivered to waiting automobiles at the destination, the suits were speedily carried to the fire.

Liners Provide Luxury for Horses on Trips across Atlantic

Transport of valuable race horses between foreign and American tracks annually involves tremendous expense to the owners and to steamship companies in preventing injury to the high-strung animals. Special box stalls are built on the baggage decks of the liners and are padded with pneumatic cushions. The upper halves of the quarters are detachable and are removed during the day to permit entrance of light and air. Often quantities of hand-picked fodder and supplies of drinking water from the home stables are taken along to prevent stomach disorders on the voyage. Veterinarians and grooms are in constant attendance, watching over their charges as vigilantly as the most attentive traveling companion to a pampered millionaire. Landing the racers is a ticklish job. For this purpose, a specially constructed crate is used. It is just large enough for one horse and a groom and is slung from the ship's crane by four chains, one at each corner. The crate is swung to the deck in front of the stall, the end removed and the horse coaxed and petted until it will enter. Tied securely and soothed by the groom, the racer is generally blindfolded before the signal for hoisting is given. The transfer to the docks takes only about two minutes and the horse is put into a motor van that speeds directly to the stables.

Unloading Epinard, a $300,000 Racer, from the "Berengaria" at New York City Docks

Birds That Topple Steeples

The stopping of the large clock in the tower of an English church, due to jackdaws having built their nests in the works, has called attention to the damage done by these birds. They seem to have a special liking for steeples and similar high places, and often cause such structures to become weakened and to tip owing to constant pecking at the mortar of the masonry. One spire threatened with collapse was found to be crumbling from the attacks of swarms of young jackdaws housed in the interior. They were gathered and lowered to the ground in buckets and the openings through which the old birds gained entrance to the tower were screened.

Pocket Volt Tester in Handy Case Saves Electrician's Time

For electrical mechanics and repair men, a pocket volt tester has been devised to save time and eliminate the danger of breakage. It consists of a durable case which holds two low-voltage lamps entirely inclosed and protected. Low signal circuits from six to twelve volts and higher voltages from forty to 700 can be tested by switching the plug. In case one of the lamps is put out of commission, it may be short-circuited and the other used. The leads may easily be extended to any length. Tests for high-resistance ground indication, field discharges and other inspections may be performed.

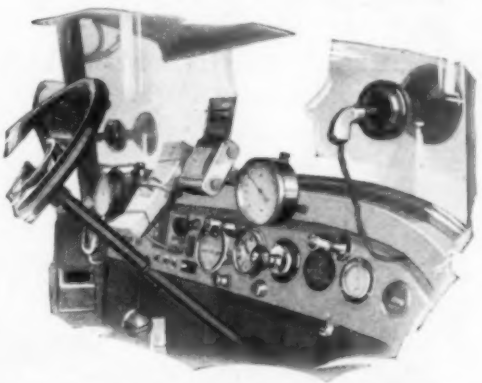
Measuring the Scarred and Stalwart Trunk of the Venerable Juniper Tree That Scientists Say Is at Least 3,000 Years Old and Possibly Antedates the California Redwoods

Juniper Twenty-Eight Feet Around Is Three Thousand Years Old

Possibly more ancient than the venerable California redwoods and known to be at least 3,000 years old, a scarred and weather-beaten juniper tree near Logan, Utah, is twenty-eight feet in circumference. Ordinarily, this species does not grow to be more than six or seven feet around. Those who have examined its twisted branches and trunk declare that it may have sprouted 6,000 years ago. It is still vigorous and defiant to storms.

"Scout" Car Measures Auto Roads with Many Dials and Meters

To obtain complete information about motor roads and driving conditions across the country, an automobile equipped with an elaborate array of special instruments was sent out from the east not long ago for a survey of several transcontinental highways. In addition to the regulation gauges, the auto carried a grade meter, altitude meter, thermometer, barometer, an adding machine, special gasoline, oil and water gauges, memoranda pads and other devices. The lubricating system was so adjusted that the car could be oiled completely by simply pressing three buttons. From the detailed "log" of the journey, motoring information for the public is to be compiled.



Instrument Board of Auto Specially Equipped to Register Wide Range of Motoring Information

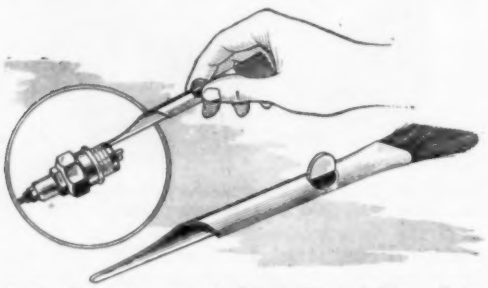
Millions of Fingerprints Filed in National Crime Bureau

To co-operate with police at home and abroad in tracing and identifying criminals, a national fingerprint bureau has been established by congress as a branch of the department of justice. Already over $50,000 has been appropriated for the work, and more than 1,000,000 fingerprints are now on file there. The bureau is to serve as a central information office, and its records at all times will be accessible to the proper officials. It is expected that this office will be of great help to cities that do not now have complete identification files of this sort, and greatly assist in the capturing of international crooks.

C. D. McKean, Chief of the Federal Identification Bureau, Examining Fingerprint Records

Spark Plug Cleaner Has Many Uses and Fits in Pocket

With a long, tapering metal point at one end and a small hard wire brush at the other, a novel little device has been placed on the market which can be used for cleaning spark plugs or smoking pipes, repairing punctures and doing many other things, it is claimed. Carbon is scraped from the inside and bottom of the spark plug with the sharp point, while the brush will give a cleaner finish to firing and electrical-contact points than can be obtained with emery cloth. It is not necessary to take the plug apart and the tool will not break, chip or crack the porcelain. When repairing punctures, the wire bristles will thoroughly clean the tube around the tear, leaving a rough surface so that the cement will hold the patch securely. With the pointed end, the hard cake in a pipe can be easily loosened, and the brush will rub away the smaller pieces, leaving the sides smooth. About the size of a fountain pen, the device can be carried in a vest pocket.



Pocket-Size Cleaner with Brush Tip and Sharp Point for Scraping Spark Plugs

Surface Temperature Is Measured by Generating Electricity

To determine quickly and easily the temperature of heated cylinders or rollers, a novel hand instrument has been introduced by a British firm. A small casting provided with a handle is supported on four wheels made of heat-insulating material. Underneath the casting, fitted to a springy steel strip and touching the surface of the cylinder, is a thermocouple, or wires of dissimilar material that will produce electricity by the direct action of heat. When brought into contact with the hot surface, the wires quickly generate electricity and the voltage produced indicates the temperature. A small cable leads from the device to a meter that measures the thousandth of a volt. The scale is graduated in degrees, so that no further calculations are necessary. To eliminate any corrections for the temperature of the room, provision is made for setting the indicator of the meter to the same degree before any readings are taken. The instrument is said to have proved of great value to industries which require cylinders maintained at a certain temperature. Another advantage claimed is that it can be run over the whole surface to learn whether the entire cylinder has been heated evenly.

Lake Turned into Land to Add Vast Area to Park System

ADDING another 1,500 acres to a city's parks, at the expense of Lake Michigan, a novel project now under way, will, when completed, furnish an unrivaled system of island boulevards, linked together and to the mainland by bridges.

In the days of the first settlers at old Fort Dearborn, the mouth of the Chicago river was located where Michigan boulevard now crosses the stream. Today the river mouth is a half mile east, pushed farther and farther into the lake by the need of water-front land for warehouses and terminals.

North of the river a tract approximately one-half mile wide and three-quarters of a mile long is all made land, and, with the improvements upon it, is valued at far in excess of $150,000,000. Great hotels and clusters of huge apartment buildings have pushed up where once the fish played in the lake. One of the largest office buildings in the world is nearly a half mile out into what was the lake. Popular Mechanics building itself is on made land, for a survey in 1821 by Captain Crim, an army officer, shows the lake shore to have been fifty feet west of

Navy Photographer Shooting the "Picture Gun" in Cockpit of Flying Boat

Copyright, Chicago Aerial Survey

Building an Island Inclosed by Concrete Sea Walls and Piles, While Sand Dredges Pump New Land into Place; Square Approaches on Shore and Island Show Future Bridge Sites

it. Opposite the business section of the city, Grant Park, a broad, treeless expanse which is to be converted into botanical gardens, and the yards and warehouses of the lake-front railroads have been reclaimed from the waters. On the north side, much of Lincoln Park, with its system of lagoons, was once in the lake. South of Grant Park the new Field Museum and the huge stone municipal stadium, now under construction, stand on recovered soil. The new projects now under way, however, are more important still.

Southward from the Field Museum, for over five miles and a half, an outer parkway is being built along the shore, while paralleling it, out in the lake, dredges, pile drivers and sand suckers are raising a chain of five long islands, to be joined to each other and to the shore parks by bridges. Over these islands will pass a direct boulevard from the far south side to the center of the city. This project alone will add 1,100 acres to the park system. Between the islands and the shore parks will be a series of connecting lagoons, for canoeing and small-boat races, and on each island will be one or more of a series of public bathing beaches. When the entire project is completed the lake front will be lined with a chain of public beaches for more than ten miles, capable of accommodating more than a million bathers at one time. Eventually, the island parks will be continued northward, with a bridge across the river, to connect with the outer park system of Lincoln Park, where a good part of the lake drives are already in operation. To the north of Lincoln Park the lake front is being shoved eastward 1,100 feet for a distance of three miles, adding 400 acres of parks and a series of bathing lagoons and boat harbors. The romance of the invasion of the lake has had many stirring figures, but none more so than that of Captain Streeter, who laid claim to the area which now houses hotels, apartment houses and other buildings valued at more than one hundred million dollars. Captain Streeter, a lake sailor, was driven ashore one stormy night more than thirty years ago, his schooner coming to rest on a sandbar. Unable to put to sea again the captain settled down to make his home on his dry-land boat. Then the lake began drifting sand about the boat, and gradually an island took form. Captain Streeter, with the assistance of other squatters who had rallied around him, gave the lake a bit of help, and soon a sand spit joined the island to the mainland, and gradually acre after acre arose from the lake's depths. Streeter laid claim to the territory, which he named the "District of Lake Michigan" and contended it was outside the jurisdiction of the state of Illinois.

For years he defended his claims in the courts and on the scene, fighting several pitched battles with police and detectives who tried to evict him. The captain and his "army" of squatters wrote many pages of colorful history before the highest courts eventually ousted him, upholding the principle that natural accretions belonged to the property owner with riparian rights on the shore, but that the lake itself belonged to the state, and any artificial tampering with its bed to raise it above the surface did not affect the state's ownership. From the earth the gradual conquest of the lake proceeds so evenly and covers so great a territory that it passes almost unnoticed, but from the air the mag-

Photo by Aerial Photographic Service, Inc.

Dotted Line Shows Old Lake Front before City Began Reclaiming Land; All Work Is Complete Except Three Upper Lagoons

nitude of the project becomes visible. From above, long rows of piles, placed with exactness in long curving scallops, etch the shore lines of the future parks. At intervals they thrust their way out into the future lagoons.

Where the invasion of the lake by the city will stop, no one can tell. The lake, being navigable, is under the control of the war department, and no work can be done without a special permit from Washington, as well as a permit from the state.

The ground already reclaimed, since Captain Crim made his survey in 1821, is estimated at 130,680,000 square feet, while 2,613,600,000 cubic feet of lake water has been displaced by land. The flow of the Chicago river, which, since the city turned it around, now empties out of the lake into the drainage canal, is regulated at 10,000 cubic feet a second. At that rate the water displaced from the lake by new land would be sufficient to keep this river, with its twenty-two-foot-deep navigable channel, going for seventy-two hours and thirty-six minutes.

Aerial photography, with its all-seeing eye, has become so important in recent years that the dredging companies have frequent aerial views taken to show the progress of their work. The photographs are superseding blueprints and maps, because they show every line of the work.

Auto with Airplane Compass Helps Map Makers Survey Roads

Fitted with an airplane compass, an altimeter and various other instruments, an automobile has been sent through southern California to chart roads and make

Instrument Board of the "Pathfinder" Automobile, Showing Compass, Altimeter and Other Devices

maps for the members of an auto club. The machine's apparatus greatly simplifies the task, as most of the information necessary is furnished on the dials. By keeping careful watch of these, the mappers can gather data for their purpose.

Federal Pure-Food Law Violations Now Total Twelve Thousand

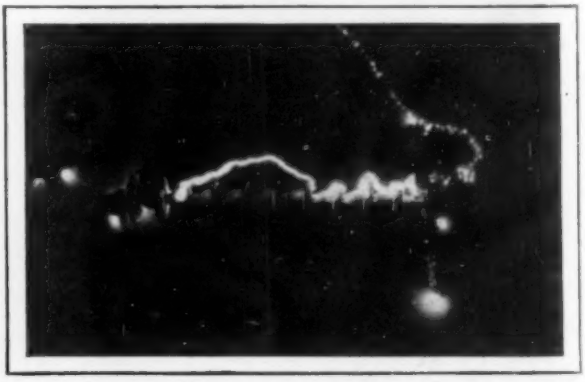
Since the passage of the pure-food and drugs act in 1906, there have been 12,000 seizures and prosecutions based on adulterations or misbranding of foods and medicines, according to reports from the federal bureau of chemistry. More than 600 of these cases have concerned shipments of eggs; 100 and more, adulterations in flour and approximately 1,000 court actions were necessary to deal with lots of dairy products of all kinds. Canned goods have been subjected to rigid scrutiny, and vigilance in this regard, according to government officials, has been rewarded by noticeable improvements in the quality of canned tomatoes, catsups and fish, especially salmon. The act requires that all foods in package form be clearly labeled to show their contents and quantity, so that purchasers may know just what they are getting. Failure to print labels according to the law caused many prosecutions.

Fear Tests with a Breaking Chair to Aid Insanity Cure

With the aid of a collapsible chair, Dr. W. E. Blatz, of the University of Chicago, is able to arouse experimentally the emotion of fear. The seat is electrically operated and made to break down with the weight of the occupant when a control is released. Unaware of the impending collapse, the patient clutches wildly for support and delicate electrodes, strapped to his arms and connected with a recording device in another room, register the effects of the fright on heartbeats and breathing organs. The inventor believes that the chair may be employed to study and treat various forms of insanity which make themselves evident in abnormal emotional states.

Way to Stop Loss of Electricity Is Sought by Engineers

With engineers advocating plans by which all large power plants in one section of the country will be interconnected into a common system to distribute the power, more attention than ever before is being directed to high-tension lines. Careful tests are being carried on to determine the character of high voltages. New types of insulators are being designed, built and tested. All kinds of cable are being subjected to high test voltages to determine the leakage under various conditions, and the whole tendency is to discover the best means of transmitting electrical energy from the large central station to the consumer, who only demands the best service. The highest tension in use at present is upward of 120,000 volts.



Aurora-Like Glow Caused by the Escape of Current from High-Voltage Electrical Contacts

Rows of Canines' Graves in Dog Cemetery, Where Headstones and Wooden Markers Indicate the Tiny Mounds

Cemetery for Dogs Has Marked Plots to Indicate Pets' Graves

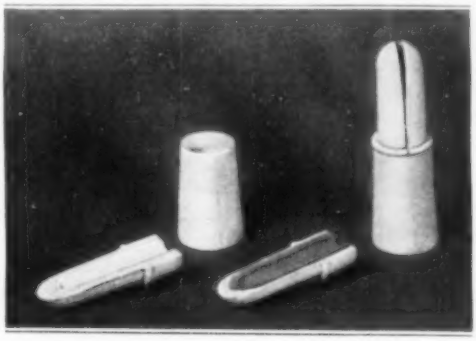
Containing the graves of nearly a thousand dogs, a cemetery in Pennsylvania, established exclusively for canine pets, has each plot marked with the name of the animal buried in it. Most of the burial spots are indicated by neat wooden signs but many have elaborate marble headstones. The inscriptions show the ages of the dogs and their owners' names. The mounds are kept in repair and fresh flowers and plants are regularly added.

Snow Is Stored in Earth in Winter and Sold as Ice in Summer

In some of the smaller towns of Europe where a supply of ice for cooling foods and drinks during the long, hot summers is important and where neither artificial nor natural ice is available, snow is stored and packed into cone-shaped pits dug in the earth where it freezes into solid lumps. After storms, gangs of men shovel the snow into carts and haul it to the pits and pack and tramp it down as hard as possible. When the heap is nearly level with the top of the pit, it is covered with a foot-thick layer of earth as a means of protection and insulation. In summer it is sawed into oblong blocks and sold in the town.

Call to Aid Crow Shooters Lures Birds toward Gunners

For the use of sportsmen and farmers, a crow call has been made that can be easily taken apart and adjusted to either a coarse or fine tone. It is said that variations of the birds' cries have different meanings and the device is constructed to imitate almost any note. By moving the mouthpiece of the instrument, the pitch of the sound may be raised or lowered easily. The call was designed to aid in efforts to keep down the numbers of the crows which, in many neighborhoods, have become a menace to game and useful birds.



Crow Call, Which Can Be Adjusted to Imitate Various Signals to Lure Birds to Gunners

Painters on Top of Eiffel Tower Risk Lives on Slender Cables

Overlooking Paris, the Eiffel tower, 984 feet high, one of the world's tallest structures, is kept safe for visitors by steeplejacks and painters who periodically risk their lives on slender cables and in fragile seats to paint the steel beams and girders as protection against rust. With their buckets slung at their sides, the workers sit in bos'n's chairs which are attached to the cables by a clamp arrangement to permit lowering as the work advances. Breezes sometimes blow with considerable force here and helpers are on hand to steady the ropes.

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Swinging from Slender Cables at Dizzy Heights Near the Tip of the Eiffel Tower, Painters Search Out Every Niche and Crevice in the Vast Network of Steel and Apply Protective Coatings to Combat Rust

Precious Cargoes of Silk Carried on Closely Guarded Trains

One of the most dramatic of all the races staged by trade against time occurs in the shipping of silk from Japan to New York. The course is 8,300 miles; the stakes are millions of dollars and to speed the precious cargoes, the swiftest steamships and specially guarded trains, known as "reefers," for which speed limits are waived and tracks are cleared even to palatial passenger limiteds, participate with seaplanes and airplanes in carefully arranged, secret schedules. The world's record on the Yokohama-New York silk course was established not long ago when the orient was brought within thirteen days, three hours and eight minutes of Manhattan. Loaded with five and one-half million dollars worth of raw silk, the steamer "President Jackson" made Seattle on the ninth day. A mail seaplane met the boat at Victoria, then flew to Seattle, one hundred miles away, with port documents and cargo papers to be forwarded to New York before the steamship docked. In three hours, the silk was inside a 12-car train waiting with steam up and its armed guards ready for the dash eastward. Fast passenger trains make the trip to Chicago in seventy hours but the "reefer" clipped five hours from this schedule. In the shipping of silk, which, weight for weight, is the most precious commodity carried next to gold and silver bullion, time is literally money.

Death of Laughter and Jokes Seen As World Becomes Wiser

An age when everyone will be too intelligent to see humor in anything is predicted by Dr. C. G. Shaw, of New York university. When all people are fully educated and developed, no one will smile if a man loses his hat in the wind, slips on a banana peel or sits down on the headpiece, in the opinion of the scientist. People laugh at what they do not understand, he says, or what seems to be inferior to them, as was the case when scoffers derived a great deal of amusement from the theories of Columbus and Galileo. Jests and funny drawings to illustrate jokes will be preserved in public institutions for the benefit of visitors who may learn of the "age of laughter" only from such relics and historical works, he declares.

Music-Roll Boxes with Hinged Ends Permit Easy Access to Records

For the convenience of piano-player owners, music-roll boxes with hinged ends have been manufactured so that records can be withdrawn or put back with little trouble. The exposed drop front bears the name of the roll and is pulled out easily

Selecting a Piano-Player Record from Pile of Boxes without Disturbing the Others

with a tab. Piled on top of the piano or in any other convenient position, rows of the containers are as handy as a filing cabinet. Any record can be quickly selected without removing the box or disturbing the others.

Models of Flowers Teach Pupils Beauties of Plant Life

To teach school children the beauty of wild flowers and the importance of preserving them, the public school ex-

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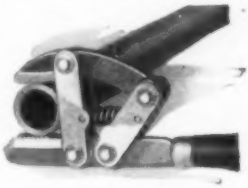
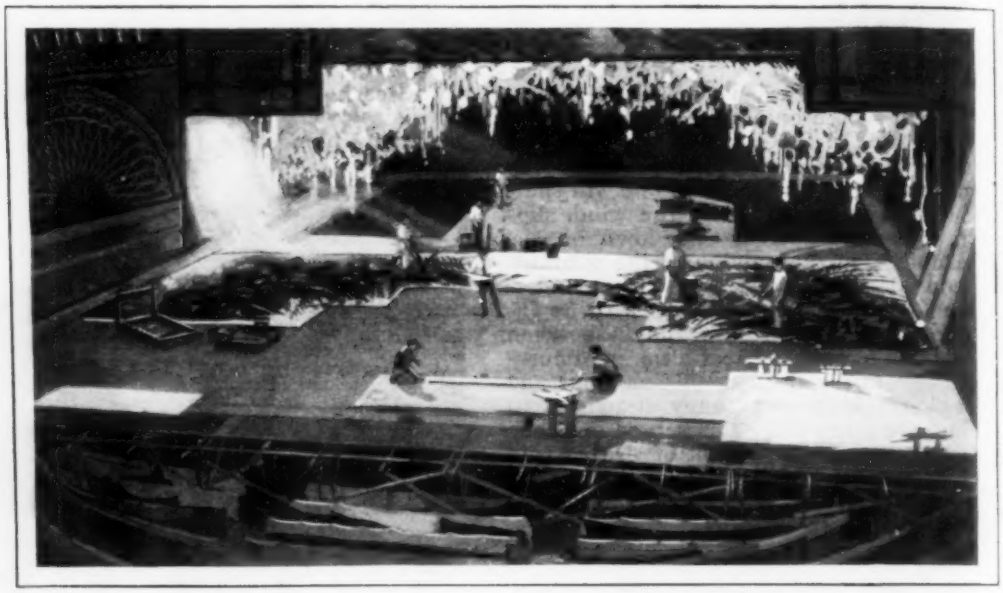
Floral Modeler of the Field Museum and Case of Blood-Root Blossoms

tension department of the Field Museum of Natural History has prepared life-size models of plants and blossoms common to the middle west. They are arranged in groups and sent to the schools in cases about two feet square together with an enlarged colored photograph of a woodland scene that may be set up as a background. The blossoms and leaves are modeled in wax, cotton and celluloid and are carefully colored in natural hues. With each case, the museum supplies a brief story of the flower as the basis for the teacher's talk.

Self-Adjusting, One-Hand Wrench Grips Pipe or Bolts

Quickly adjusted to various sizes of pipe or nuts, without thumbscrews or other devices, a strong steel wrench that grips from the front between especially tempered ratchet jaws, has been designed for many purposes. It is prevented from slipping off while being turned or when the hands are removed by a stout spring that holds the jaws tightly to the work when once adjusted. This wrench has been found specially convenient in close quarters, for instance, where a pipe lies against the wall, and for many purposes about the automobile.





In Turning a Large Theater into a Studio, Platforms Built over the Seats and Joined to the Stage Form Gigantic Easels to Hold the Canvases while Busy Painters Ply the Brush

Painting Acres of Scenery for Opera

Close of Season Begins Work of Corps of Artists Who Give Life of Color to Canvas Walls

IF it were not for the skill of the scenic painters and a corps of other stage artisans who ply their crafts during the summer months, the beginning of the opera seasons might not find the brilliant array of properties and settings necessary to an elaborate repertoire, awaiting the first flourish of a conductor's baton and the ascension of the "opening" curtain.

When the last aria has been sung and the final orchestral crash marks the end of the "run," swarms of artists and draftsmen set upon the task of creating new settings for the following season's program of plays, converting the dimmed theater to a gigantic studio where overalls, paint cans and brushes replace glittering costumes and gilded scepters of strutting actors on the stage. The "wings" and "flies" are dismantled, curtains are taken down and properties stored to make room for large palettes on wheels, which are pushed back and forth across the floor of the platform by busy painters wielding long-handled brushes they dip in large containers of color carried by the squat trucks.

Unlike ordinary picture artists, the scenic painter does his work while the canvas is spread out on the floor and for the preliminary grounds and coats the broomlike brushes are used. About thirty-five tons of paint and 45,000 square yards of gauze, netting and linen are required annually by the Chicago Civic Opera company to complete its scenes for each season's productions. The framework upon which this expanse of colored fabric is fastened consumes more than 80,000 feet of lumber.

The settings for the various operas are first built in miniature by designers whose study of the subjects results in true copies in the finished structures. These models are painted and fitted together in the same way they are to appear on the stage, even small doll figures and lights being provided to demonstrate desired effects. When ready for the artists and builders, the models are given to the stage draftsmen, who make blueprints of the plans, covering in detail every step of construction. The surfaces to be painted are divided into squares one yard wide, which correspond to similar checkered patterns on the blueprints. By this arrangement the outlining artists can see how much

Outlining a Drawing for an Interior Set That Will Serve as a Fitting Background for Brilliant Ensemble. Left, Miniature Model of Opera Stage Made to Accurate Scale for Guidance of Scenery Builders

Scenic Artists Painting Linen and Gauze Fabrics with Long-Handled Brushes They Dip in Troughlike Paint Pots Carried by a Palette That Rolls on Casters So It Can Be Easily Pushed About

space is permitted for each figure, scroll, or other object which is to grace the canvas wall and aid the painter to follow the drawings with a great degree of accuracy. Following the rougher preliminary coats come the ornamental shadings, edgings and the filling-in of delicate tints. This is done with brushes nearer the ordinary sizes, since careful work is required to prevent a daubed appearance of the finished settings.

As the scenes are completed, they are sent to the carpenter shop where they are cut and trimmed to sizes suitable to the stage. No piece of scenery can be more than five feet nine inches wide, although when viewed from the front of the theater many settings appear to be a solid unbroken mass of decorated material. This effect is the result of hinging the separate sections together so that when they are opened out, the edges will seem to blend with each other. Cutting and joining the different parts require skill of experienced craftsmen, as the beauty of design cannot be sacrificed to size. As a guide to the trimmers, the models are again brought into service, giving the carpenters an accurate scale from which to work.

All windows built in the settings are backed with strong wire netting and when the canvas is attached to this with rubber screen, the appearance of genuine glass panes is obtained. Each section of a set is plainly marked on the back with the name of the opera to which it belongs, the number of the scene, and its position in the assembled background. This precaution speeds up the erection of the settings and in plays consisting of many scenes results in a great saving of time in getting the stage prepared with the various changes.

During extensive tours the company makes use of many stages of varying dimensions and to take care of these differences, the scenes are constructed so they can be telescoped and "shrunk" to fit. By a system of planning before the painting is started, the designs are formed so that nothing can be concealed or distorted when the pieces are shortened. Careful grooving and constant reference to the scaled miniatures insure this "elasticity" while the canvases are being adjusted to the frameworks in the carpenter shop.

Scenic Painters Working Up Scrolled Designs on Section of Gorgeous Drop Which Is to Add Color and Reality to Classic Setting for One of the Operas of Elaborate Repertoire

In a single summer season between five and ten operas are painted by the artists. Such a task generally calls for more than a hundred workmen. At the large operatic theaters the stage is enlarged to accommodate the painters, notwithstanding that the platform is among the largest in the country. Scaffolding is erected over the seats of the main floor of the theater and temporary flooring is laid down to extend more than halfway across the house. Using this as an easel, the canvas and other fabrics are spread out, allowing plenty of room for the artists and their wheeled paint pots to move freely about the tasks. When finished, the scenery is carefully stored in protecting racks.

Electricity from Windmills Seen as Relief from Coal Cost

Further attempts to harness the winds are reported from France where engineers are said to be contemplating the construction of a number of two-bladed windmills, each with a radius of 100 or 300 feet, to generate electricity for light and power and thus escape the excessive cost of imported coal. The type was devised after a series of experiments on top of the Eiffel tower to find the best means for utilizing the power of the wind. It is estimated that the smaller mill will give fifty horsepower in a thirteen-mile wind and the larger ninety. They are expected to afford 240 and 400 horsepower respectively when the wind blows twenty-two miles an hour. At a central control station, the varying currents from a number of the mills will be transformed into one of constant intensity for the consumers.

War Tanks Turned into Tractors Fill Thirty-Acre Lot

French tanks that were originally intended to sweep over "no man's land" were recently unloaded at Los Angeles, solidly packing thirty acres of ground. The entire lot had been transformed into tractors for tilling American farms. The huge collection had lost the wartime armor and taken on the appearance of efficient "caterpillars," each with power enough to do the work of several horses.

Thirty Acres of Wartime Tanks Transformed into Fleet of Powerful Tractors for Tilling the Farms

Nearly Half of the Arctic's Insects Represented in One Box

Within the space of a small box, specimens said to represent nearly one-half of the living creatures found in Arctic regions are preserved in the National Museum, at Washington, D. C. They form a collection of flies and mosquitoes, some of them having been obtained within 550 miles of the north pole. There is no vegetation in most parts of this region, so the insects prey on animals and men. Mosquitoes encountered in these northern latitudes are said to be unusually large and have an insatiable appetite during the short summer. Scientists estimate that the insect world has five times as many different species as all other living things put together.

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Case Containing Specimens of Nearly Half of the Insects to Be Found in Arctic

Tree for Treating Leprosy Cultivated in U. S.

Cultivation of chaulmoogra trees, the oil from which has been found effective in combating leprosy, has been started at a government station in Maryland. About 670 of the plants are now being tended and more than 2,000 have been shipped to Hawaii, the Philippines, the Canal Zone and Porto Rico for transplanting, as there is no place in this country where they will develop fully.

Rider, Chained to Bicycle, Begins Trip around World

Chained and manacled to his bicycle, an Ohio man has started to pedal his way around the world. He already has completed several hundred miles of the journey which he expects will take three years, as his progress is limited by his bonds. He must eat, sleep, bathe, shave and do everything within six feet of his bicycle—the length of the chain that holds him. At the start of the trip, the chief of police of Toledo snapped the manacle in place on the rider's right wrist and filled the keyhole with molten lead so that it cannot be unlocked.

Bound to Bicycle by Chain and Wrist Manacle, Rider Starts Trip around World

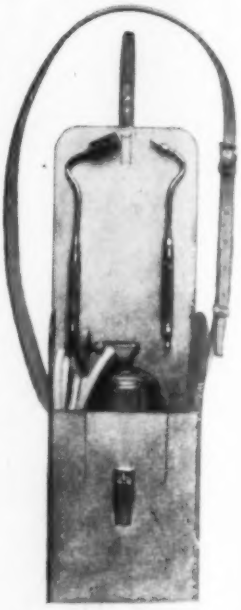
Camp Oven Holds Cooking Utensils and Clamps on Automobile

So it can be carried on tours, a cooking oven for campers has legs that clamp securely to the running board of an automobile. Made to burn wood, the stove contains compartments holding many necessary utensils. Its size is such that it cannot block the entrance to the car, and it is constructed to protect the contents from dirt and dust. The oven can be easily and quickly set up and dismounted and has a chimney that fits neatly on the inside for packing. Made of strong metal it is said to resist much of the rough usage of camp life.

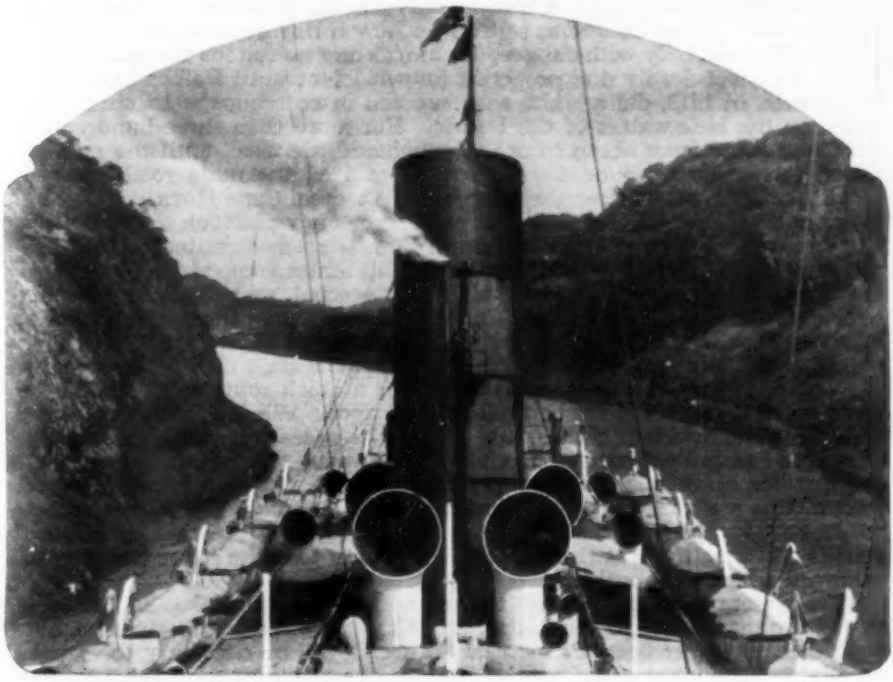
Sounds Produced by Fish Are Heard through Water Microphone

What sort of a noise does a fish make? This question has been answered in part, at least, as a result of experiments performed not long ago by dropping a watertight microphone into the tanks at an English aquarium. Each tank seemed to give a different basic tone. With the crayfish, there were noises like the snapping of a watch case. The question as to whether fishes actually emit sounds other than those made in feeding, was not decided.

Airman Carries Tiny Welding Outfit for World Flight Emergencies



One of the most important items of the equipment carried by squadron leader MacLaren, one of the British contestants in the flight around the world, was a small but complete welding outfit. The source of the heat is acetylene gas in the dissolved state stored in a cylinder seven inches long and three inches in diameter. No oxygen tanks are needed as the speed of the gas when entering the burner is used to draw sufficient air into the interior. Two torches are included in the outfit, a "pencil" blowpipe and a high-temperature tube for bigger flame. For connecting the gas cylinder and torches, thirty-five feet of high-pressure rubber tubing are included. The entire apparatus is contained in a neat leather case with shoulder straps.



View Taken from the Crow's Nest of Round-the-World Steamer in Gaillard Cut

What the Panama Canal Means to You

WITH the celebration of the tenth anniversary of the opening of the Panama canal just a few weeks ago, it was announced that more than 25,000 vessels had passed through the waterway. Over one-fifth of that number made the trip between the Atlantic and Pacific in the single year ended June 30, last.

Despite all handicaps, such as landslides, the traffic has increased so rapidly that tolls during the last fiscal year reached $24,290,963.54, as compared with $4,367,550.19 in 1915, and the vessels which have utilized the canal saved 196,825,000 miles by not having to go around South America, a distance equivalent to 7,873 voyages around the entire earth. Operating expenses last year were only one-third of the gross revenue.

Due to the stupendous growth in traffic, plans have been completed for additional locks, bigger than any now in use and capable of lifting the "Leviathan" or "Majestic," more storage reservoirs and an auxiliary steam-electric plant to curtail the waste of water in generating hydroelectric power.

Four hundred and twenty-two years ago Christopher Columbus, on his fourth and last voyage to the new world he discovered, sailed into a little Central American bay in search of a "secret strait" to the East Indies. He failed to find that waterway, as did Balboa and others who followed after, for nature had neglected to build it, but this year's celebration of the realization of the great mariner's dream was held in that same little sheltered cove, Limon Bay, now the Atlantic terminus of the canal.

Four hundred and twelve years passed from the day of his arrival until the canal was formally opened to the ships of the seven seas, but in the ten years that have since elapsed the old navigator's estimate of the value of such a link between the oceans of the east and the west has been so abundantly proved that congressmen are even considering plans for a second canal, to be ready against the day when the present route cannot handle the stream of traffic.

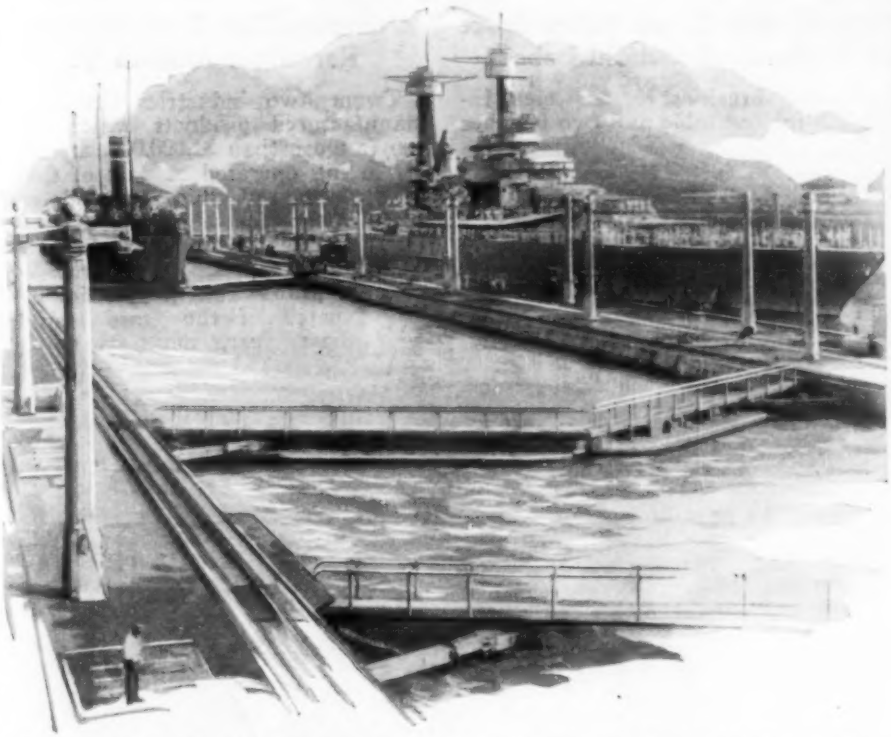
The present canal is a mechanical marvel and a monument to man's triumph over nature. When Columbus sailed into Limon Bay he faced an impenetrable jungle, filled not only with dangerous animals and poisonous snakes, but, worst of all, the most deadly disease germs known. Not until Balboa came, eleven years later, in 1513, did a white man succeed in crossing the isthmus to look down on the blue waters of the Pacific. For more than three hundred years the short route from ocean to ocean remained little used, until the gold-maddened forty-niners, bound for California, utilized the mule road across the heights to cut months from the long journey around Cape Horn.

Another three decades, and a French company undertook to build a canal. They started work in 1882, gave it up in 1889, started again, but yielded to the disease germs, and finally, in 1904, the United States stepped in. In ten years the canal was completed, locks built, dams erected, and machinery installed, but not until General Gorgas had fought and won one of the greatest battles of all times, resulting in the rout of the army of yellow-fever germs.

Opening, as it did, within a fortnight after the start of the European war, the waterway leaped into immediate need as a quick route from the far-flung outposts of the world to the battlefields of France. When America entered the war the traffic doubled and trebled. It is in its peace-time uses, however, that the canal has proved its commercial value. In the fiscal year ended June 30, the number of vessels using the route increased more than thirty per cent. Part of this was due to the fact that the canal has made Vancouver an ocean wheat port for western Canada. It is cheaper to send the grain by rail to the Pacific and then by boat through the canal than to route it for the long haul eastward across the continent.

At present the canal utilizes the water from its giant lakes and reservoirs to develop the electric power to operate lock gates and other mechanism, but to cope with the great fleets of the near future, it will be necessary to install an auxiliary steam plant to reduce the wastage of water now used for power purposes. Each time a lock is filled and opened its contents is wasted, and with

Midway between the Atlantic and Pacific Oceans, Where Large Ships Can Navigate under Their Own Power



U. S. Battleship "California," Passing through Miraflores Lock from the West on the Way to Meet the "Opposing" Fleet during a Series of Naval Maneuvers Held in Panama Waters

more ships to handle, it will be necessary to save all the water for lockage purposes only. Other changes which experts advise include a new storage dam on the Alhajuela river to control and husband the flood water emptying into the Chagres river; another reservoir near the locks on the Pacific side, and also an additional set of longer locks to handle vessels of great size.

Even these changes, Captain A. W. Hinds, U. S. N., marine superintendent of the canal, says will be in the nature of temporary relief, and eventually we should have another canal. This being the case, there has been recent agitation in Washington for the revival of the Nicaraguan project. The navy department is particularly interested in this, as the Panama canal is not easily fortified against aerial attack, lacking outlying islands and headlands for defensive purposes, while the Nicaraguan route has the Corn islands in the Caribbean and the Bay of Fonseca headlands on the west coast for defensive purposes. Since the completion of the canal American naval strategy has been based on the possibility of shifting the fleet hurriedly from one coast to the other, but if an enemy could destroy one canal the fleet might be caught divided and annihilated. Naval strategists claim with two canals, the second easily defendable, the danger would be reduced, while the additional route would care for the traffic which the present canal eventually will not be able to handle.

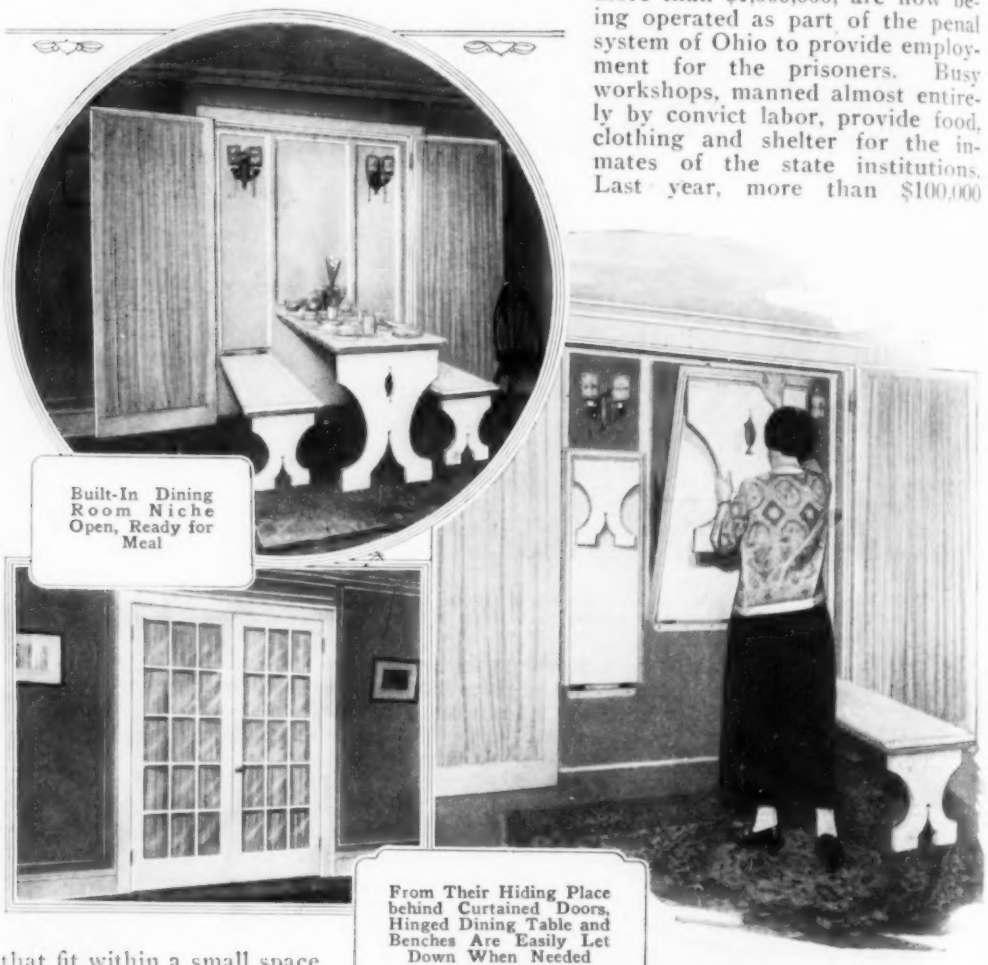
The success of the Panama route was assured from the start because of the enormous saving in mileage which it makes possible. From New York to San Francisco, via the Strait of Magellan, is 13,135 nautical miles, while the distance by the canal is 5,262, a saving of 7,873 miles.

Among the benefits given the United States by the canal are reduced freight rates, quicker delivery of goods, closer relations with South America and a short cut for its fleet in war times as well as peace.

Sept. 1, 1924. H. H. WINDSOR, Jr.

Folding Dining Room Saves Space and Lightens Household Labors

For serving breakfast or any meal informally, a folding table and two benches that fit within a small space in the wall and are entirely concealed behind two attractive doors when they are not in actual use, have been invented. For dwellers in small apartments and for all households that appreciate saving in space, time and trouble, this set, which practically makes two rooms out of one, has been found especially suitable. There is ample space for four persons, and it takes but a few moments to prepare the table and seats or to hide them again. They are hung securely on hinges and rest in a niche six inches deep. The doors, curtained with attractive material, resemble French windows. Decorative wall lights within the recess furnish illumination for the table.



Built-In Dining Room Niche Open, Ready for Meal

From Their Hiding Place behind Curtained Doors, Hinged Dining Table and Benches Are Easily Let Down When Needed

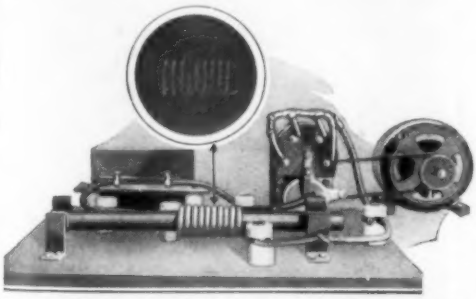
Prisoners Run Score of Industries Earning a Million Yearly

Twenty-two industries that last year manufactured products which sold for more than $1,000,000, are now being operated as part of the penal system of Ohio to provide employment for the prisoners. Busy workshops, manned almost entirely by convict labor, provide food, clothing and shelter for the inmates of the state institutions. Last year, more than $100,000 was paid to the prison workers in wages calculated on a basis of from one to five cents an hour. Furniture, clothing and shoe factories and a sheet-metal and structural-iron plant that makes all the beds used in the state institutions are maintained, and at the state penitentiary alone, there are thirteen well-defined industries including textile and planing mills. Last year, more than 1,000,000 automobile license plates were made by prisoners. The state also owns 13,223 acres of land, of which 7,208 acres are under cultivation.

Shipwrecks occurred at the rate of one every day last year, according to statistics.

Stop Electric Leaks in Auto Wires by Using Braided Covers

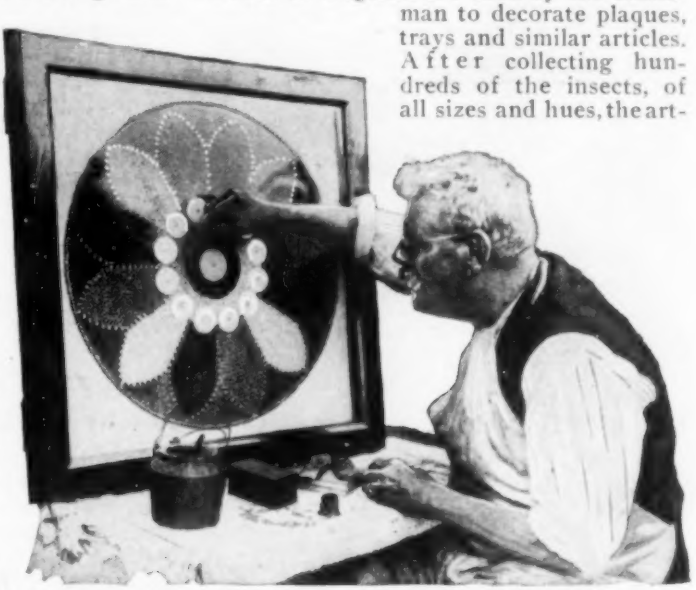
Experiments conducted by the Underwriters' Laboratories to solve the mystery of why insulated wires on the high-tension systems of automobiles break down in use have revealed that the breakdown is due to the electrical "corona," which is sometimes seen on dark nights around high-tension transmission wires. The experiments also disclosed that the corona effect was practically removed when wire with a braided cotton cover was used, while wire with plain cotton cover broke down, in some instances, in six minutes of use. A braided-cover wire was operated 240 hours during the tests without destroying the insulation. In the experiments the wire to be tested was wrapped around a one-inch steel bar which had been grounded, and the ends were connected to form a circuit with a motor-driven magneto and a spark gap. The high voltage created by the magneto, intensified by the "piling up" which occurred each time it jumped across the spark gap, produced the necessary tension. The corona was plainly visible in a dark room and no difficulty was encountered in photographing it. The laboratory is continuing the experiments to determine why the braided covering on wire checks the leakage. As a result of the experiments it is hoped to eliminate the leakage which has caused much trouble.



Electric Testing Apparatus Trying Out Insulation on Wire Wrapped around a Charged Steel Bar

Pictures Formed of Butterfly Wings Match Painters' Art

Formed of brilliantly colored butterflies' wings, artistic designs created by a watchmaker in England are used by the craftsman to decorate plaques, trays and similar articles. After collecting hundreds of the insects, of all sizes and hues, the artist cuts the wings into small petal-shaped sections. With these the gorgeous figures are carefully worked out, each piece being glued to the foundation. Each design is accurately outlined before the tiny scales are attached and the colors are matched as closely as possible with those in the original of the picture. Most of the wing "drawings" are reproductions of popular flowers.



Copyright, Keystone View Co.

Artist Working Up Picture of Dah'ia with Minute Petals He Cuts from Butterflies' Wings Taken from Hundreds of Various Species

Over Thousand Accidents an Hour Cause Heavy Loss in U. S.

An average of twenty-one accidents occur every minute in the United States, according to figures compiled by the government, those caused by automobiles leading in number. Baseball is said to head the list of mishaps in athletics and sports, while polo has the lowest figure, in a similar report made up by an insurance body. This record does not include accidents to campers or persons on hiking trips or pleasure tours. One insurance company reports that fifty-six policy holders were accidentally killed in the past ten years while engaged in recreation.

Pistol Is Hidden in Auto Lever Ready for Quick Defense

Designed for instant use, a double-barreled .22-caliber pistol is contained in the detachable handle of an automobile gear-

Inserting Pistol in Gear-Shift Lever, and Diagram Illustrating How It Could Be Used

shift lever now manufactured in France. A quarter-inch turn of a metal band next to the knob separates the handle and pressure on a section of the stem discharges the weapon. The pistol is automatically cocked when the handle is replaced. An alternative model for the hand brake has also been placed on the market. Attached to any standard automobile, it is claimed that the weapon can be brought into action more quickly than one the driver may have on his person.

Pupils' Weak Eyes Cost Taxpayers Millions of Dollars Yearly

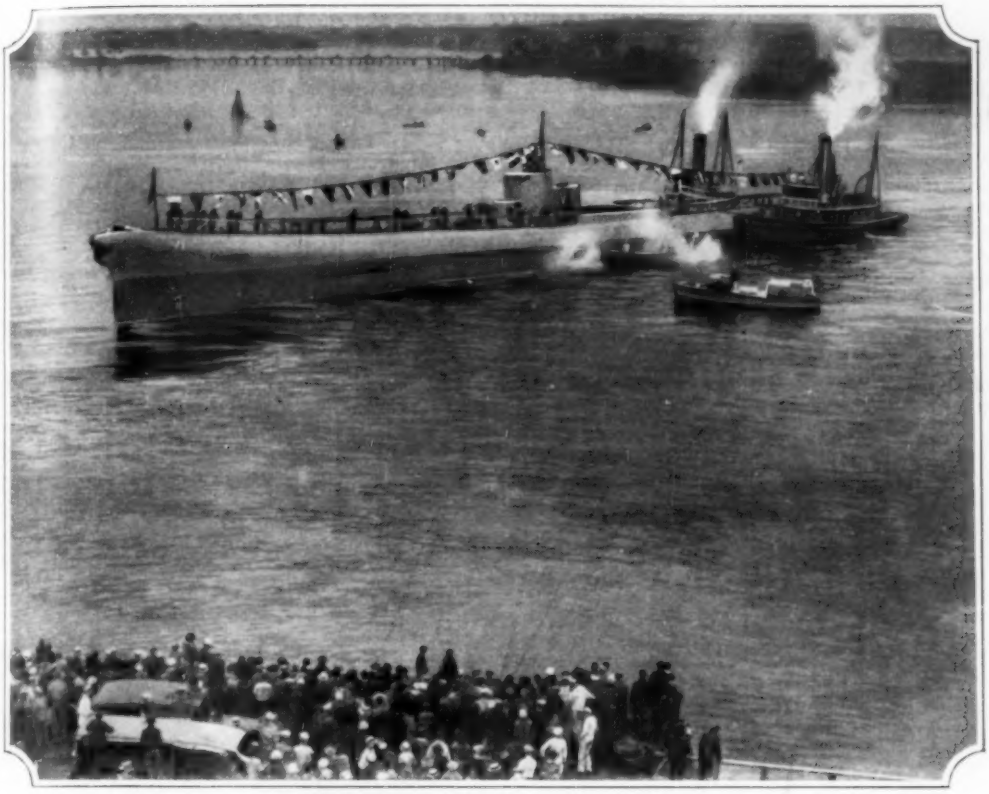
Defective eyesight of pupils in the public schools of this country costs the taxpayers at least $130,000,000 every year, according to reports of the eyesight-conservation council of America. This huge cost is due to the fact that thousands of students are compelled to take two or more years for a single grade because faulty vision has made them backward in their work. It is figured that the cost of public elementary and secondary education in the United States averaged, in 1920, $64.16 per pupil per year. On the basis that each of the 6,000,000 retarded children dropped back for only one year, the cost would be $390,000,000. It is estimated that about one-third of the number of delays were caused by poor eyesight, thus causing an expense of $130,000,000. The report further states that this estimate is believed to be too low, as studies made in two cities of 5,815 retarded pupils showed that a total of 12,970 school years were lost, making an average of more than two years for each pupil. These figures do not include the tremendous loss to the child due to lower earning power. In one large city, it was shown that of 7,319 pupils found with defective vision, seventy-two per cent were backward in their studies, while correction of visual defects among a large number of others resulted in from seventy to eighty per cent of them taking their places in classes with average normal children of their own age.

Metal Mask Aids Insomnia Victims by Quickly Inducing Sleep

To aid insomnia sufferers, a Norwegian inventor has perfected an aluminum mask that is said to quickly induce sleep when worn by a patient. Fitting snugly over the face with only an opening at the nose for air to be inhaled, the mask prevents any light from distracting the attention of the wearer while the warm breath of the mouth is forced to the eyes. In a short time, it is claimed, the patient will be asleep.

Copyright, Keystone View Co.

Aluminum Mask over Face That Induces Sleep by Forcing Warm Breath to Eyes



Shortly after Launching; the Giant Submarine "V-1" with Its Gay Pennants Is Welcomed to the Sea and Preparations Are Made to Complete It for Voyage across the Atlantic

Giant Sub Able to Cross Atlantic with Crew of Eighty-Seven

The fighting efficiency of Uncle Sam's navy will be greatly increased, officials believe, by the "V-1," the giant submarine, nearly twice as large as any previously built here. It is said to be capable of sailing as fast and as far as the battle fleet in any kind of weather and will not need the services of a "mother ship." The huge boat, the first of a fleet of nine similar fighters to be built, can cross the Atlantic and return without replenishing its supplies of fuel. With a displacement of 2,164 tons, it develops a speed of twenty-one knots at the surface and nine knots an hour submerged. It is 341 feet six inches long, has a maximum breadth of twenty-seven feet eight and five-eighths inches and will carry a crew of seven officers and eighty men.

Jupiter, the largest planet, is 86,500 miles in diameter while Mercury, the smallest, is only 3,030 miles.

Adjustable Easy-Chair for Workers Reduces Toilers' Fatigue

To reduce fatigue of persons who work sitting, an adjustable chair with seat and back that can be made to fit almost any individual is being manufactured by an English concern. Both the height and angle of the backrest can be quickly changed to relieve strains on the occupant, and when not in use, the chair may be folded and stored under low benches or desks or will serve as a table to support trays, packages and similar objects. It is said that with the use of the easy-chair workers do not tire as quickly as with the ordinary types.

Fantastic Figures for a Fairyland of Fun Add Their Lure to the Entrance of a Pleasure Palace Dedicated to Mirth and Merriment

From Cyclones to Houses of Mystery

How the Mechanical Wonders in Modern Outdoor Amusement Parks Are Invented and Constructed

ALTHOUGH dedicated to pleasure, the modern outdoor amusement park makes use of the genius of the inventor, the skill of the engineer, the knowledge of the keenest students of human nature and every mechanical device known to science. Behind its tinsel scenes, glowing lights and the picturesque figure of the "ballyhoo" are to be found some thirty large manufacturing plants and thousands of skilled craftsmen, all of whom are constantly seeking new ways to amuse the public. In the parks themselves — and there are more than 500 in the United States, with a yearly income estimated at more than a billion dollars—are to be found almost everything needed for human existence.

Such an organization, for instance, has its own ice plant, fire department, police service, hospital with doctor and nurses, and vast storehouses that resemble the quartermaster's department of an army post where supplies for restaurants and concessions are kept.

In addition, there are private bottling works, butcher shops, a printing plant that prepares all the tickets used and turns out a weekly newspaper for the park, and elaborate business offices where busy clerks sometimes have to count and wrap upward of $50,000 in small coins a day.

Many parks operate their own power plants and the weekly bill for electricity runs into untold thousands of dollars. In one of them there are more than thirty motors, ranging from twenty-five to 500 horsepower, which operate the rides. Three motors are required for some of the larger coasters. A big Ferris wheel, ninety-eight feet in diameter, with twenty-four cars and weighing 200 tons, is so perfectly balanced that a twenty-five horsepower motor is sufficient to operate

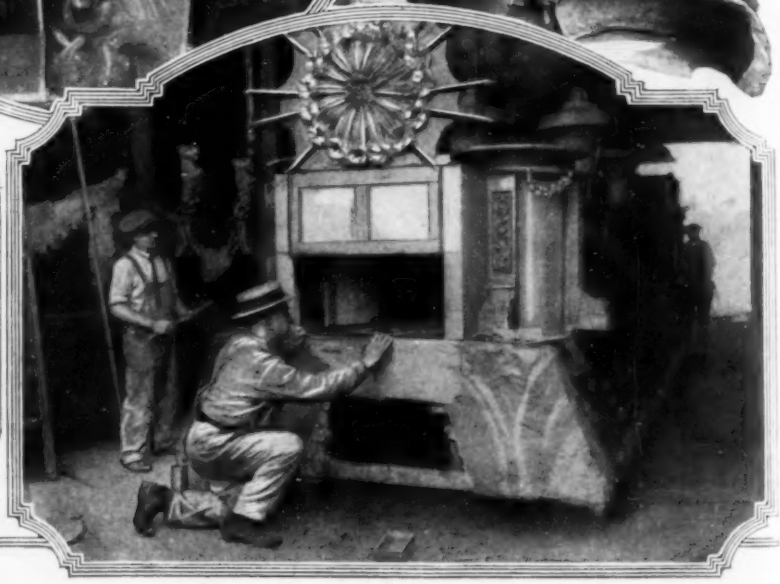
it. Combined, the motors will carry a peak load of more than 2,000 horsepower. Then there are millions of electric lights. In one tower alone 20,000 are used, part of the approximate 100,000 that are strung about the buildings and grounds. Another large park pays $2,000 a week for electric lights alone. But momentum and not glitter is the chief use for electricity at these pleasure cities and the attention of owners and inventors, as well as the public, is centered on the rides. More than any other one feature, they have increased the total attendance figures to approximately 100,000,000 persons a year. Coasters are acknowledged to be the most popular, although the merry-go-round, invented in 1837 by Michael Dentzel, a German wheelwright, who got his idea from spinning a cart wheel about a pivot to allow the rims to cool, is often the most reliable money-maker. This season, a wholly new set of thrills was made possible from the coaster, which is the development of the old "switch-back" built by L. A. Thompson, father of the gravity ride, for Coney Island in 1884, by the invention of a two-wheeled train.

With this patented equipment most of the difficulties of the old four-wheeled car have been eliminated and engineers say a new standard for speed has been established. It is safe to snap about a hair-pin curve in one of these trains at express-train speed and not only turn, but drop at the same time, the track being built at an extreme bank to make the twist. One park with this apparatus, packed 3,250 feet of breath-taking ride into a small lot. Trains descend from a height of fifty-five feet and plunge into a startling whirl of curves and dips. At places, a drop of twelve feet to a ten-foot straightaway was achieved. Safety brakes and balances at all times guard the train which is estimated to weigh over seven tons when the cars are loaded. Over $22,000 was spent for the lumber in this ride alone and the structure was put together and certified by an expert engineer before the public was admitted. A small car ahead of the first passenger seats serves to give balance and direction to the load and under the rails a projecting flange of the car trucks act as a double protection on the curves. One variation of the coaster has been provided in the "Cyclone Bowls," two sets of spiral tracks about a hundred feet in diameter across the top. Pushed by an electrically operated beam, the cars whirl up the tracks on one bowl, are dismissed and sent speeding across to the descent in the other bowl where they go thundering down the spiral decline to the bottom under the pull of gravity. The merry-go-round has been duplicated in its essentials and thrills added by the "Caterpillar," a comparatively new and ingenious contraption, that spins its occupants about a circle full of ups and downs and at the moment maximum speed is achieved, shuts them from the outside world by a canopy suddenly raised and dropped from the back side. The rest of the ride is in complete darkness and to the outside, the device resembles a huge, undulating, green caterpillar spinning in a frenzied circle.

Mechanical Butterflies with Gilded Wings and Seats for Two Soar Gaily around Happy Circuits

In the construction of rides, park owners say, the day of haphazard methods is over and the modern "thriller" is always

Inside Studio Where Skilled Artists Design and Construct Floats for Mardi Gras Parades; at Left, Converting Old Show Bills into Tons of Confetti

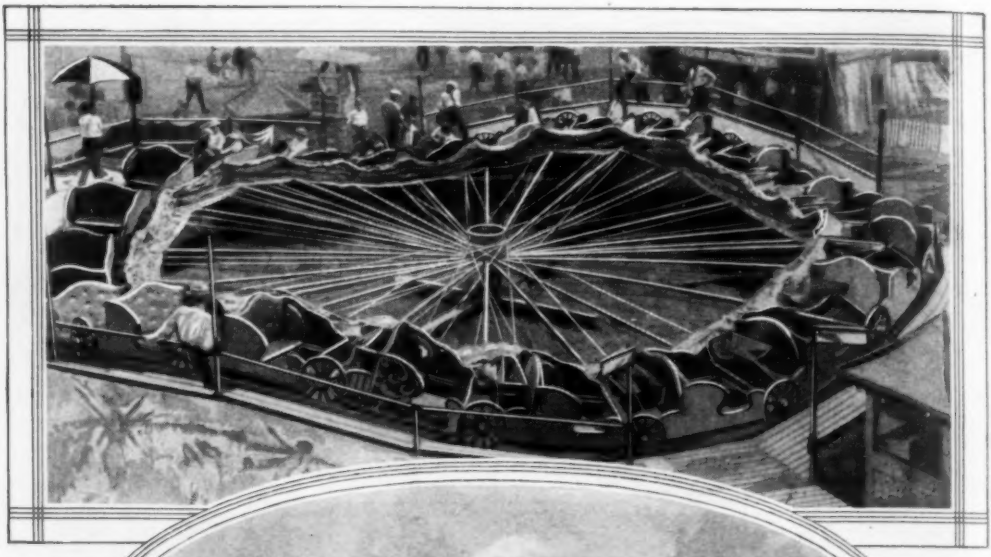


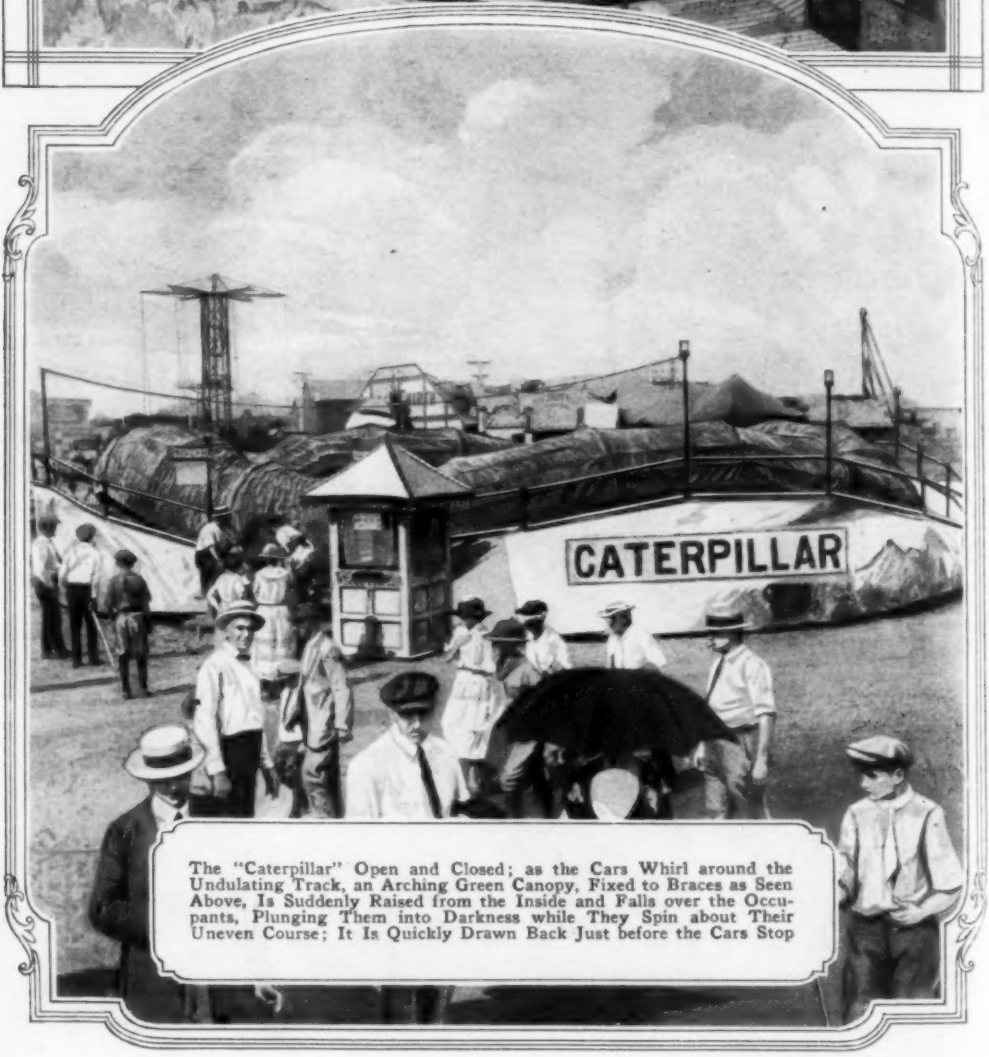
Laying Outer Paper Covering on Wire Framework at Base of Float before Applying Finishing Paints and Decorations; Batteries and Switches for Illuminating Piece Are Put in Opening above Worker's Hand

Toy Airplanes Whirl the Little Tots in Safe and Joyous Circles

Bumps and Giddy Twists Thrill Riders in the Electric "Dodgem" Cars

Proud and Gaudy Carnival Cars Add Splendor to Amusement Park Parades



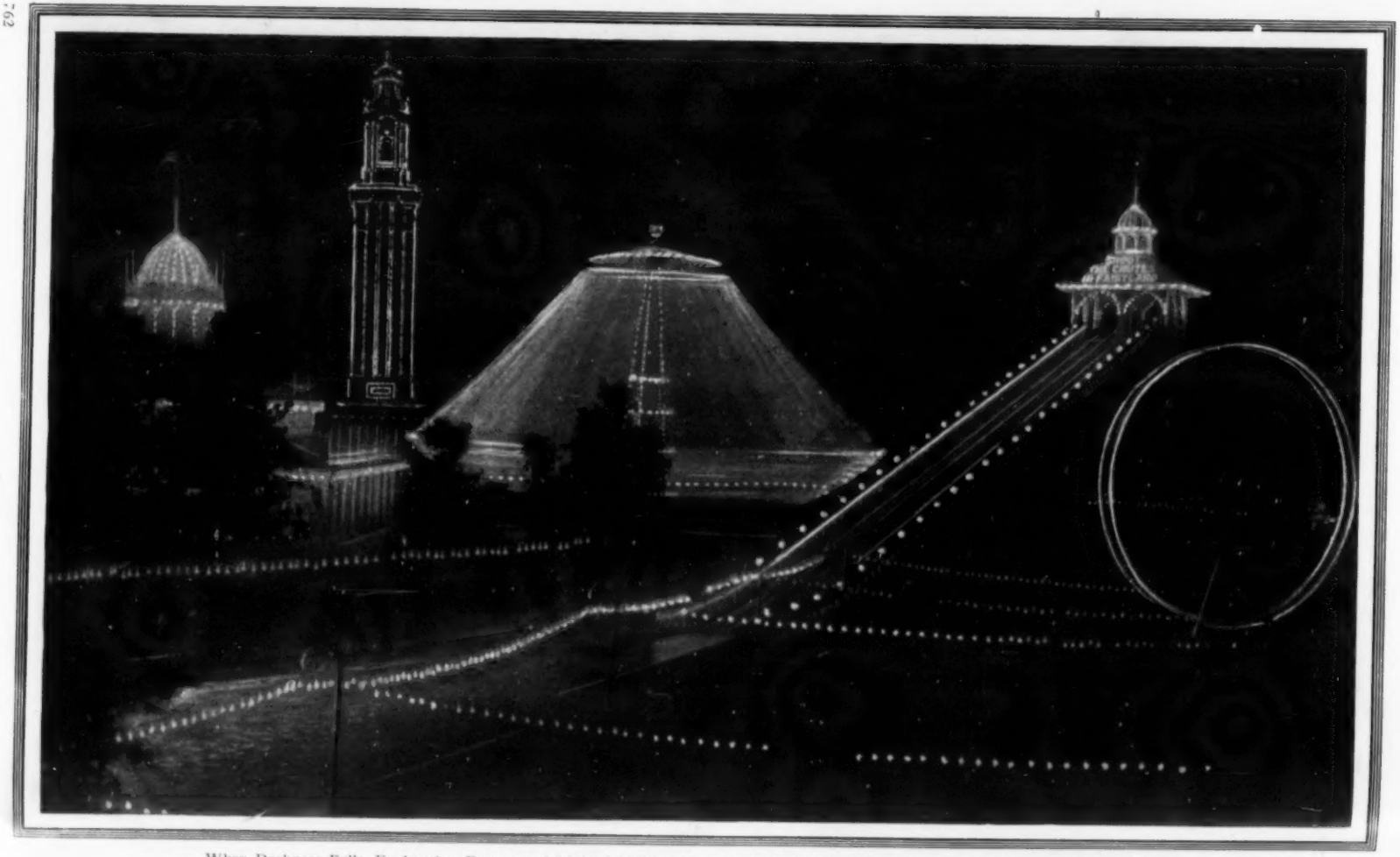


The "Caterpillar" Open and Closed; as the Cars Whirl around the Undulating Track, an Arching Green Canopy, Fixed to Braces as Seen Above, Is Suddenly Raised from the Inside and Falls over the Occupants, Plunging Them into Darkness while They Spin about Their Uneven Course; It Is Quickly Drawn Back Just before the Cars Stop

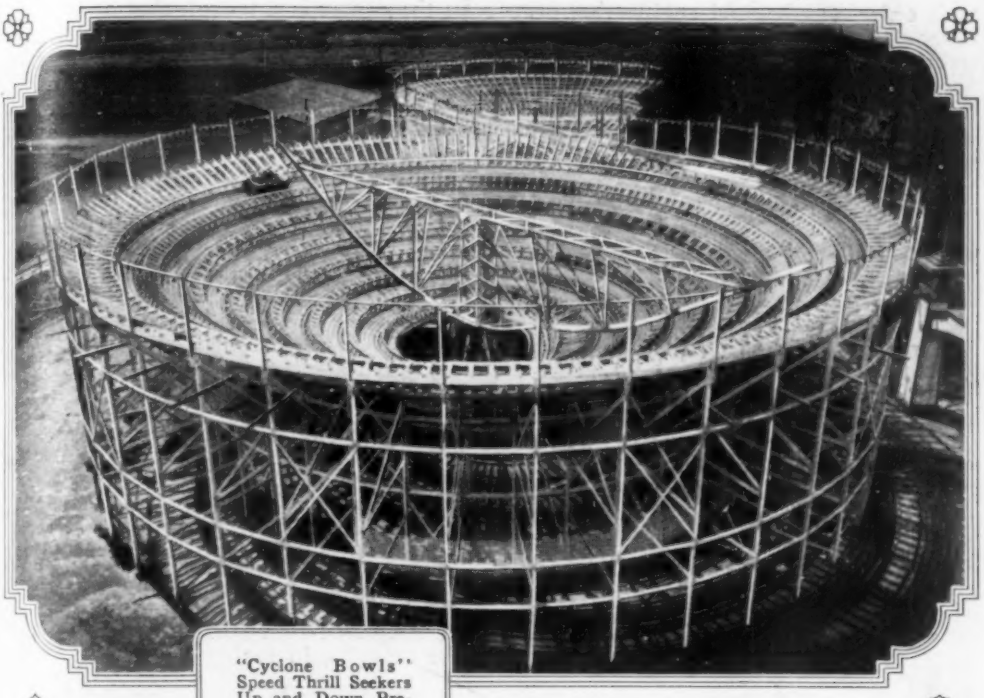
Testing Model of the "Whirling Dip" That Gives Patrons Sensations of a Rough Sea

Roller Coasters with Dips and Sudden Twists That Call Forth Gasps and Shrieks of Joy Never Fail to Please

A Mechanical Fox Chase Gives Excitement and Offers the Sportsman a Chance for Speculation on the Winner



When Darkness Falls, Enchanting Festoons of Light Add Their Lure to Call the Pleasure Seeker to the Summer Park's Delights



"Cyclone Bowls" Speed Thrill Seekers Up and Down Precipitous Whirlpools of Delirious Motion while Others May Enjoy an Orgy of Dish-Breaking

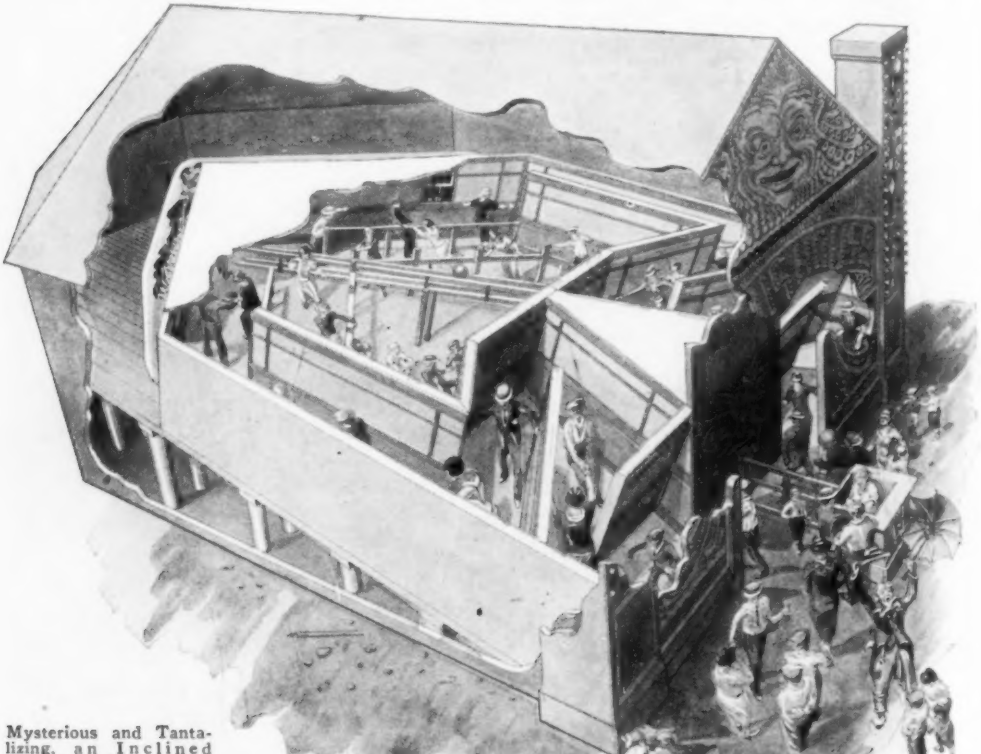
When Darkness Falls, Enchanting Festoons of Light Add Their Lure to Call the Pleasure Seeker to the Summer Park's Delights

built on safe and sound engineering principles. Rigid inspections of all rides are frequently made and caution signs are displayed. One large park has operated for more than twenty years, handling over 25,000,000 persons in that time and has had but three fatalities, none of them being due to faulty equipment.

With the new rides, a quieter but no less amusing device appeared this season known as the "Mysterious Sensation." Here, people were enabled to entertain themselves to a great extent, a point that the fun merchants are emphasizing more each year. The device is said to have been inspired indirectly by a cyclone. An architect chancing through a village that had been wrecked by the storm entered one of the leaning houses. The sensations he experienced in trying to walk across the floor gave him the idea for the amusement device. Mystification starts with a turn at the entrance to what appears to be an ordinary room. The steeply inclined passageway and another abrupt turn add to the sense of confusion. Another turn reveals a wide room set with railings and with the floor leaning at a steep angle. In the center is a trough that appears to be slanting upward at an angle of at least forty degrees to the upper corner at the opposite side of the room. A bowling ball at the bottom is slightly touched and solemnly proceeds to mount the apparent incline as though drawn by a hidden magnet. At the top, it drops through a slot and rolls in a reverse direction on another trough that seems steeper than the first.

Lurching toward the exit, holding to the railings and constantly endeavoring to get their bearings, the mystified occupants of the room finally manage to gain the doorway and are saved from a headlong dash against the wall by a conveniently placed divan in the hallway. A glimpse through a round window reveals the outside world evidently upside down with pedestrians marching up steep ascents and all the buildings leaning backwards. A moment's recovery in the open air and a glance about tell the story.

The room is built within an outer shell at a steep angle and passage is arranged diagonally across it so that the occupants are subjected to a sort of double "pull." The troughs, in reality, are nearly level.



Mysterious and Tantalizing, an Inclined Labyrinth Holds Merriment for All Who Walk across Its Floor

Inspector Brinton of Philadelphia Police Department Giving Masked Detectives Demonstration of Identification Turntable He Devised for Inspecting Suspects

Masked Sleuths Study Criminals Placed on Revolving Tables

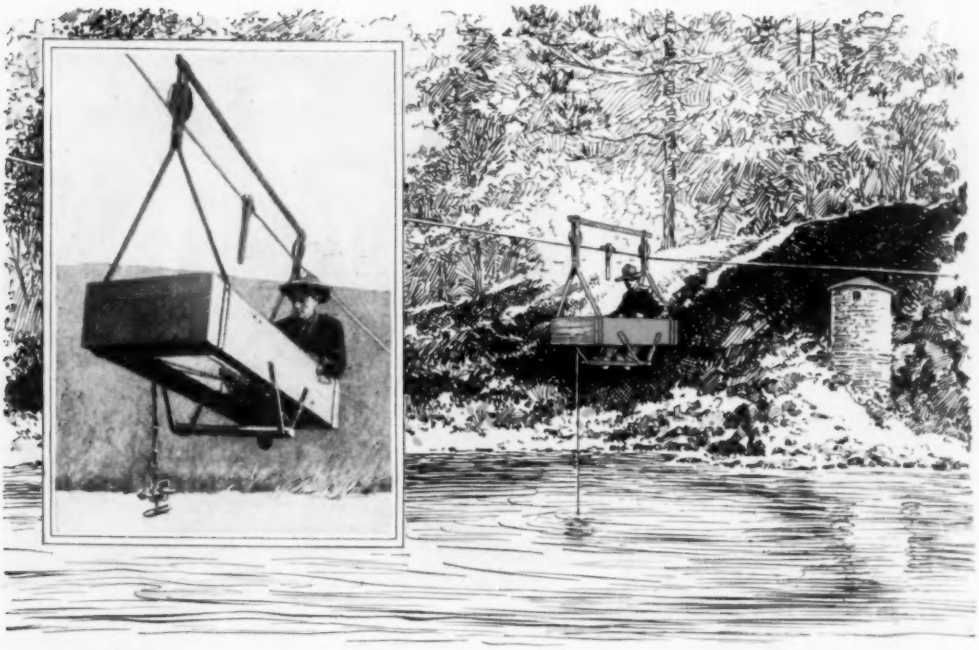
Part of the routine for criminals and suspects captured by the Philadelphia police is a ride on a turntable while masked detectives, grouped about the room, thoroughly study their figures and features from every angle. The ordeal is calculated to confuse a suspect who may be hiding under a false identity and gives the detectives ample chance to recognize the prisoner and identify him more easily later, should the need arise.

Electricity Keeps Fish from Death in Irrigation Canals

To prevent fish from entering irrigation canals of the west, a method has been devised by which electrodes are immersed in the water at the mouths of the ditches and an electric current sent through them. When fish swim in the vicinity of these devices they are subjected to slight shocks which cause them to instantly dart away in other directions.

Rubber Bathing Helmet Protects Swimmer's Eyes and Ears

Fitting snugly over the upper part of the head and face, leaving only the mouth exposed, a rubber bathing cap, somewhat like a diver's helmet has been invented, to protect the eyes, ears and nostrils in diving and swimming under water. It permits the user to open his eyes without difficulty or danger of infection as they are guarded by watertight goggles, attached to the rubber, and glasses may be worn while swimming as the sides of the cap fit tightly enough to hold the bows in place. The lower edge of the helmet effectively excludes all water from the ears and nose and may be rolled up over the forehead if the user wishes to shield only part of his face.



Where Bridges Are Absent, the Water-Power "Scout" Spans the Stream with a Cable and Basket Car, Dropping and Raising the Gauge as He Propels the Carrier along the Aerial Track

Harnessing Water Giants to Do Your Work

Government Scientists Pave Way for Engineers by Measuring Speed of Current in Streams

INSURING almost inexhaustible supplies of electric current to practically every nook and corner of the country, gigantic super-power systems combining hundreds of plants in expansive networks of energy sources, are planned as an achievement to lighten the tasks of households and reduce the operating costs of industry. Already accomplishing the work of more than 170,000,000 men, the force that lies behind the switch of the electric circuit, is to be garnered into large central "reservoir" stations placed at strategic points throughout vast areas. This means a mobilization of power, whereby the tying together of producing electric plants will eliminate waste and permit surplus energy to be sold from one plant to another that might experience a shortage. This, it is expected, will greatly reduce the cost to the user, and it may even be that the feed line carrying power for the transportation of a big city's bustling life will also transmit force to the farm dweller's dishwasher, thresher, reaper and to do the work of the butter churn at the same time it supplies the operating element to a painter's spray brush high up on a skyscraper on the other side of the state.

The ready availability of electric power to the needs of every department of industrial and agricultural life, it is held out, will permit the lessening of hand labor, both in home and factory. The seamstress will find it more to advantage to use power for sewing, while all the work of the kitchen can be accomplished in a short time at low cost by the electric servant, leaving the housewife free to pursue activities more to her liking. And the automatic hammer in the hand of the mechanic may strike more blows at less expense per blow.

To determine the definite possibilities that lie awaiting development throughout the entire country, the government is constantly studying the streams in all parts of the nation. Velocity of the current, volume of water, and the depth, are all

Hydro-Power Plant Where Energy from Remote Mountain Streams Is Harnessed to Produce 20,000 Horsepower of Electric Force; the Current Is Developed under a High Head of Water, as Is Shown by the Rush of the Tailrace

Digging Holes in the Frozen Surface of a Wide River through Which the Measuring Instrument Can Be Lowered to Register the Winter Flow of the Stream

Water-Power Surveyor Seated in a Traveling Chair, Swinging above a Swollen River, While He Takes Soundings of Its Depths and Gauges Its Velocity; Similar Apparatus Are Installed at Hundreds of Points throughout the Country and Are Regularly Read by Inspectors

combined to show just what energy could be derived from the normal flow. Even in winter when the surfaces are frozen to considerable depths the survey proceeds, since the season makes it important from the standpoint of needed power for heating and lighting. A series of holes is cut in the ice stretching the full width of the channel, and through these the instruments taking measurements are thrust.

Cables are swung across swift rivers and from these the current meters are suspended. Readings are taken at regular intervals during day and night, for where the streams are fed from snow-capped mountains, the volume of water varies with the rising and setting of the sun. Small cars are hung from the stretched lines in which the inspectors can traverse the width of the streams to check the figures registered by the instruments. In isolated sections and along the courses of the most important streams, automatic self-registering gauges are installed and are operated by a clock-like arrangement which records the changing depths of the water on a roll of paper. Resident attendants inspect the apparatus twice a month and engineers visit it several times during a year.

There are now something like 3,200 water-power plants in the United States with a total capacity of more than 9,000,000 horsepower. As a result of the stream-flow investigations, it is an easy matter to estimate the possible resources yet untouched. Reports show that there are at least 34,000,000 horsepower yet unmobilized for industrial purposes, which can be made available for nine-tenths of the time.

In computing the estimates and seeking out the remote sources of water-power energy, hardly a stream is overlooked. Cascades and swirling rapids racing along between towering walls of deep gorges are spanned by the wire bridges to carry the tiny swinging cars of adventurous engineers over the treacherous depths. Shore anchors for the cables are tested, but occasionally a weak spot in the contrivance precipitates the "explorer" into the stream, as a line snaps or the fastenings give way. Where permanent bridges are in place, fixed gauges are set up and daily readings recorded from these, so that the survey bureau is always in possession of information that shows the exact condition of the stream at any time of a day or year.

Taking Readings of Water Current and Depths from a Footbridge, Showing a Cross Section of the Stream and the Meter Which Registers the Speed and Volume Passing through the Channel

One-Cent Postage Stamp Is Valued at Thirty Thousand Dollars

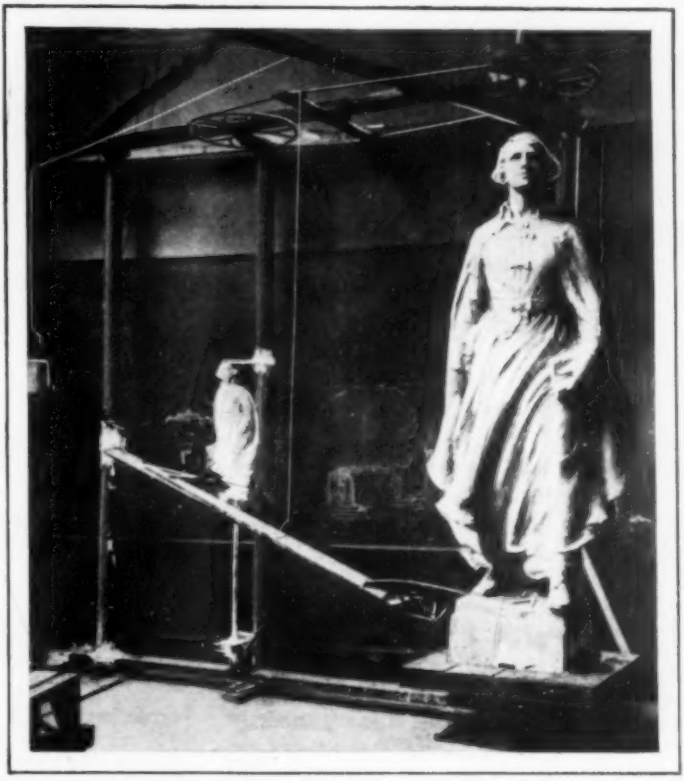
Sold for a cent in 1856, a British Guiana postage stamp about the size of one of our two-cent variety and bearing a black-ink impression of a crude woodcut on red paper, is now valued at $32,500. It is the only one of its denomination of that issue and is said to be the most valuable stamp in existence. This tiny bit of paper is to the world of stamp collectors what the Cullinan and Kohinoor are to the realm of diamonds. The British Guiana stamp is now owned by a New York man who is also the possessor of the second most valuable stamp known as the Mauritius, No. 2, valued at $15,000, issued in 1847. Mauritius, No. 1, a one-cent stamp printed in orange on a bluish white background, is valued at $12,500 and another very valuable issue is that of 1851-52 of the Hawaiian Islands, a two-cent blue stamp worth $10,000. The most valuable stamp ever printed in the United States is one of a five-cent issue from the town of Boscawen, N. H., in 1846 and is valued at $12,000.

Subways Shake City's Foundations to Depth of Forty Feet

Down to its clay foundations, forty feet below the surface, the English metropolis is being constantly shaken by the jar of subway trains and street traffic, according to Prof. J. A. Fleming, of the University of London. In time, he says, this steady vibration will weaken the structure of the buildings. His observations have been made with the help of a delicately adjusted concave mirror so suspended that when a sound wave strikes it, the vibration causes it to move and project a ray of light upon a screen above it. By the motion of this beam, the intensity of the disturbance can be determined. In early mornings, when traffic is quiet, the quakings subside.

Mechanical Fingers for Sculptors Simplify Reproducing Models

Modeling large figures from small originals in plaster has been simplified by the use of an enlarging device, which consists of three posts or bars in a frame arrangement, two of them connected by a chain passed over pulleys. Extending from the fixed bar is an arm attached by a ball-and-socket joint. At the free end are finger-like extensions. As the arm is swung to different points on the model, the fingers indicate a corresponding position over a platform, and the sculptor builds the clay up to that point. Thus he is able to duplicate mechanically every line and depression in the original. When the larger figure is done, it is reproduced in plaster and from this, the bronze is cast.



Sculptor's Enlarging Apparatus, Showing Big Piece That Has Been Reproduced with Help of Mechanical Finger Pointing from Tiny Model

¶Perches placed on a lighthouse by the British Royal Society for the protection of birds have reduced the destruction of birds that become confused by the lights, from nearly 1,000 a night to less than that number in a whole season.

One-Man Tractor Grades Roads, Digs Ditches and Cuts Grass

An efficient road grader, operated by one man and run by a farm tractor, has been put into use in New York. Both engine and scraper are slung on an arching steel frame that connects the big rear tractive wheels with the two smaller ones in front used for steering. The operator stands on a center platform where he can regulate the blade and control the machine. The grader can dig ditches, cut and scrape grass at the roadsides, and effectively level off bumps, it is claimed.

Copyright, Underwood & Underwood

Compact One-Man Road Grader That Is Pushed Along by Tractor Engine and Heavy Wheels

Airplanes Aid in Studying Diseases Spread by Wind among Plants

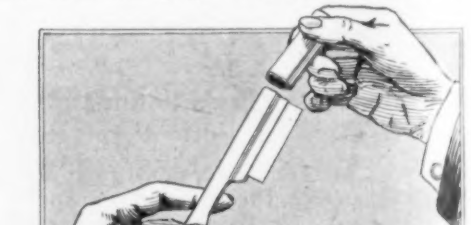
Exploring the upper altitudes with airplanes to determine what part the wind plays in spreading diseases among plants, investigators for the department of agriculture have found pollen grains and minute spores floating at heights of 10,000 feet and more. The planes were equipped with spore traps, the most successful being in the form of slides treated with vaseline and arranged in compartments so they could be exposed or closed at will. The tiny particles were gathered as the air came in contact with the slides and were found relatively abundant at altitudes up to 11,000 feet, while two spores were found at a height of 16,500 feet. Aerial explorations of this kind already have been performed in Texas, Nebraska, Wyoming and Minnesota and have demonstrated, officials say, that the airplane is a great aid in studying the distribution of plant diseases.

Flavors of Hams Are Told by Smell While Teas Are Tasted

The quality of freshly cured hams prepared by large meat packers is determined by expert "ham-smellers" who test each piece by its aroma before permitting it to be taken from the storeroom. Many years of experience are necessary to develop skill in the art of distinguishing between the properly cured article and that which requires additional treatment. Among the bigger concerns many thousands of hams are turned out each day, all of which must pass through the hands of a corps of inspectors whose sense of smell proves the condition of the product. In a similar manner, teas and coffees are tasted by experts, who select the beverages for wholesale firms.

Stropper for Safety-Razor Blades May Be Used as Knife

Any safety-razor blade may be resharpened easily and quickly with a hand stropper that may be carried in the pocket. Being the same thickness at the back as a straight razor, the device fits the hand and allows a firm grip. The blade lies flat on the hone at the correct angle to give a keen edge. By using the ridged back and replacing the clip, an excellent ripping and cutting knife is made.



Stropper Designed Like Straight Razor to Insure Grip, Showing How Blade Is Inserted

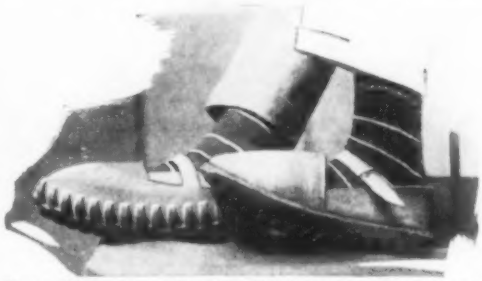
Airplane Compared to Supply of Oil and Gasoline Necessary to Lubricate and Fuel Its Engine on a Cross-Country, Non-Stop Flight from New York to San Francisco

Planes' Range of Flight Is Limited by Fuel-Carrying Capacity

The army's "dawn-to-dusk" flight across the continent on June 23 and the round-the-world trip have revived discussion of the possible limits which new and spectacular flights may reach. The non-stop journey from the Atlantic to the Pacific last year by Lieuts. Macready and Kelly demonstrated that the weight of fuel and oil is at present the biggest factor in determining the limits of cross-country flying. Their previous experience in breaking the world's duration record by flying thirty-five hours and eighteen minutes in the same plane, showed that the limits of the ship had not been reached on the twenty-six hour and fifty minute cross-continent voyage. Some idea of the amount of fuel needed for a flight across the United States is gained from the fact that they carried 10,850 pounds of load when they left New York, including 737 gallons of gasoline and forty gallons of oil. In previous attempts they had been unable to fly from the Pacific to the Atlantic because the plane could not lift this immense load over the tall mountain ranges along the California coast. By starting from the east, however, they burned up enough of the weight to let the plane cross the ranges of the Rockies. Lieut. Russell Maughan, who succeeded June 23 in making the dawn-to-dusk flight, burned almost as much fuel as the non-stop fliers, but was not troubled by the weight, as he made the journey in five hops, the longest of which, from Cheyenne, Wyo., to Salduro, Utah, was 585 miles, and was therefore able to refuel frequently. He also traveled a shorter route than the non-stop fliers, who were forced to go far south into Texas and New Mexico to find low mountain passes which their loaded ship could cross.

Footgear from Old Automobile Tires Replaces Leather Shoes

Among the peasants and workmen of Spain, shoes made from cast-off automobile tires are being worn instead of the leather and wooden varieties. Cobblers make the footgear to order for their customers, using the outer tread for soles and the inside fabric for the uppers. A strong strip of the lining serves to hold the shoe to the foot. It is said that such articles

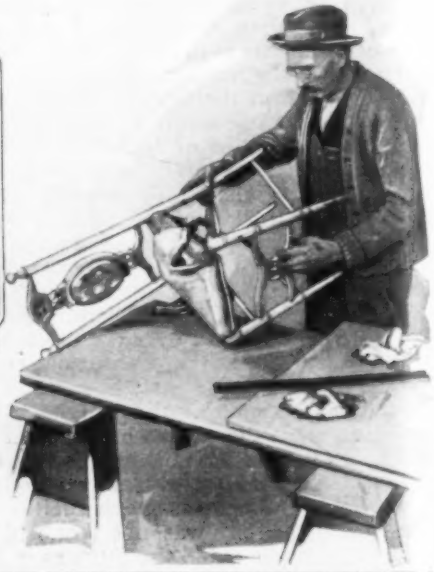


Shoes Made by a Spanish Cobbler from Treads and Inner Fabrics of Cast-Off Auto Tires

are suitable for wear in almost any kind of weather met with in that country, and are much cheaper than those made from other materials.

At Right, Sorting Cast-Off Garments for Charitable Society for Mending and Distribution

Doll Hospital of Benevolent Institution Where Damaged Toys Are Gathered after Rescue from Trash Bins of Big City and Undergo Repairs at Hands of Experts Who Make Them Good as New for Needy Youngsters



Off to the Rubbish Heap; Load of Mixed Waste Materials That Will Be Subjected to Scrutiny of "Pickers" at the Dump; Right, Once Beautiful Chair Reclaimed from Junk Pile for Repair and Sale

Mending a Cast-Off Phonograph Taken from a Rubbish Heap

Trimming Old Burlap Bags into Covers for Open-Head Barrels

Cutting Up Iron Strips with Power Shears in Junk Shop

Fortunes Found in Nation's Junk Heaps

Cast-Off Materials Once Thought Worthless Become Basis of Industry That Gathers Them for Sale to Manufacturers

THAT the familiar rag picker, crying his wants in city alleyways and bartering for junk along country roads, is part of a great industry, is shown by the fact that hundreds of millions' worth of scraps and waste is annually gathered by these "prospectors," and others who search the trash piles and rubbish dumps of the nation for cast-off materials they sell to be reclaimed and converted to new uses. Millions of tons of such junk are gathered every year from all parts of the country, and thousands of people are kept employed in handling it and making it into other products that will ultimately be scrapped in their turn. Buying as cheaply as they can, the wandering "collectors" sell to others who maintain "junk shops." Every city and town has at least one of these. In Chelsea, Mass., a space of thirteen acres is devoted to

Sorters Weighing Rags Gathered on a City Dump, Using a Salvaged Wash Boiler as a Receptacle

what is said to be the largest junk market in the world. In the smaller places, the materials are sorted for sale to specialists. Wool rags go into one pile, cotton and linen into others, bottles into barrels according to size, and miscellaneous articles are thrown into classified heaps.

In the waste-paper business in New England alone, a total amount of $10,000,000 each year is received in payment for the more common product which the packers sort into forty-two separate classifications, each with a different name to indicate the grade. From a city the size of Boston, thirty to forty tons of newsprint waste paper are collected every day and shipped to mills where it is made into high-grade paper board. Colored printers' clippings, such as tissue and light stock, are sent to concerns that cut it up into confetti, while heavier stuff goes to the manufacture of wallboard. During one year paper mills spent over $50,000,000 for waste paper. Old news stock is even exported to China, where it is used to make a cheap form of clothing.

Regularly published market quotations on old and waste materials include mixed papers, old rope and strings, heavy and light scrap metals, scrap rubber, mixed rags, painted aluminum, printers' rags, dark cotton and pewter. Many such classifications are due to various cleaning processes the articles undergo before being offered to the trades.

Much waste is also imported, but all must go through fumigation and inspection by government agents. Scrap iron, often referred to as the "steel industry's second line of defense," is considered a vital link in steel production. Big metal dealers buy it in vast quantities from railroads, mills and building wreckers, selling it to plants who use between several hundred and 30,000 tons a month. Altogether about 7,000,000 tons of such junk are purchased yearly by the mills.

For many years the United States navy department sold its scrap metal and other waste to the highest bidder, regardless of what the huge piles of material contained. Then it was decided to call in an expert junk dealer, who established a system of grading and appraising the accumulations before offering them for sale. The result was a remarkable revision in dealers' bids and the receipt of more money for the scraps.

Formerly the large hotels in New York had to pay cartage for the removal of broken china and crockery, but now this is done for them without charge by concerns that buy this material and melt it down for the gold they derive from the edges, monograms and decorative lines. City dumps yield fortunes to many junk dealers, who employ hundreds of people to pick over and sort the stuff.

Dissecting Huge Anchor with Acetylene Torch in Naval Junk Yard Where Dealers Perform Much Preliminary Work before Carting Materials Away to Be Sold for Manufacture into Other Products

Skill of Scientists Assures Safety of Travel on American Trains

Provisions made by American railroads for safeguarding the lives of their passengers go far beyond the watchful engineer and the elaborate and accurate system of automatic signals. Before material for the locomotives is bought, before a car is constructed or a tie laid, chemists and engineers are at work over test tubes and burners in their laboratories, subjecting the raw materials used to rigid examinations to detect any possible flaws. Metals are tested with special care and pulling and weight-dropping machines are employed for testing rails and axles. Locomotive and car axles are required to withstand a blow resulting from the fall of a ton weight from a height of forty-three feet. Among other materials and objects which must pass through the laboratory are engine and stay bolts, paints, lubricating and burning oils, coal, coke, wool waste for the journal packings, caustic soda for the electric batteries and even drinking water at the stations and in the cars is tested.

Electric Windshield Wiper for Auto Requires Little Current

Operating electrically from a storage battery, a windshield wiper has been marketed which will remove snow, sleet, rain or mist from the glass regardless of engine speeds or road conditions. Of simple construction, the wiper works with a back and forth movement with a current consumption less than that required for a headlight. The device will also work while the automobile is parked, a switch from the driver's seat controlling it. A metal spring insures close contact of the wiper arm with the windshield, preventing it from sidelashing or springing away from the glass.

Colorado has the greatest average altitude and Delaware the least of the states in the Union.

Mail Boxes Set in Gateway Column Serve Colony as Post Office

Honeycombed with tiers of mail boxes, large concrete posts marking the entrance to a rural-residence division near Indianapolis act as a safe repository for postal matter for the entire colony. Sixteen small compartments and two large vaults for papers and parcels are built in each column, one post being provided for the dwellers on each side of the street. Heavy doors guard the interiors of the receptacles, keys to which are held by the owners. Wide slots in the covers permit rapid distribution of mail by the postman, and the contents of the boxes are protected from all kinds of weather. Being close to the sidewalk, any section of the post can be conveniently reached.

Concrete Column at Entrance to Rural Subdivision Which Serves as Post Office for Colony

U. S. Tire Output Increasing

While the combined production of rubber tires for automobiles and motorcycles in the principal countries of the world amounts to 54,500,000, more than four-fifths are consumed by vehicles in the United States. About 46,000,000 casings are manufactured here each year, of which a little over a million are exported. It is said that this difference is due to the number of machines in this country.

U. S. Sailors Serve as Steeplejacks While Painting Liner's Funnels

Riding in bos'n's chairs or clinging to ladders, sailors on the "Leviathan," at least once a year assume the role of steeplejacks when they paint the liner's towering funnels. The three smokestacks are nearly seventy feet high and each is large enough to permit the largest locomotive ever built to pass safely through its interior. Thousands of gallons of paint are required to cover the huge liner, which is 950 feet long and 100 feet from keel to top deck.

Copyright, Underwood & Underwood

Squad of Nimble "Steeplejack" Sailors of the U. S. S. "Leviathan," Painting One of the Liner's Gigantic Funnels from Bos'n's Chairs

False Banknotes Detected by "Feel" in Hands of Experts

Because of the secret treatment of paper stock when printing banknotes in the government bureau of engraving, counterfeiting is said to be made more difficult, since bank clerks, business men, and others familiar with the characteristic "feel" of paper money, can easily detect the imitation article when handling it. Although the usual silk threads found in paper currency may be traced in by pen and ink, they may be revealed by close inspection. Protection from photo-engraving the designs is obtained by a process that changes the color values when subjected to such treatment, and the seal requires painting in with water colors, since, in counterfeits, the black lines of the background show through. The most difficult spurious bill to detect, it is claimed, is one of low denomination which has been bleached out and replaced with a false print of higher value. Sometimes the only test which can reveal the fraud is the system of numbering and lettering that marks each note. Each one bears a treasury number, and if this figure is divided by four, the remainder should be 1, and the serial letter A. If the remainder is 2 the letter should be B; when 3 is left, C designates the series, and D in case there is no remainder. Results that show otherwise denote a counterfeited bill. One of the most usual methods of fraud in gold coins is the practice of sawing the disks in half, extracting the metal on the inside and replacing it with some cheap material before carefully joining the two pieces again.

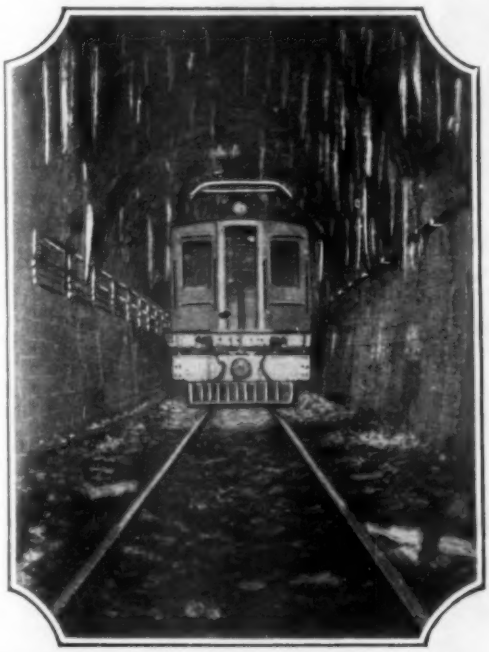
Copy of Fourth U. S. Patent Found; Was Signed by Washington

Written in longhand, a copy of the fourth patent granted by the United States government has been found among the archives at Washington. It covers a device for making punches and matrices in the manufacture of printing types and was awarded to Francis Bailey, a Philadelphia printer, in January, 1791. It bears the signatures of President George Washington, Secretary of State Thomas Jefferson and Attorney-General

Edmund Randolph and also the seal of the nation. Since that time, about 1,500,000 patents have been issued and the task of hearing and passing on the applications has become one of the most important government activities and requires the services of hundreds of workers.

Quarter Million Tons of Explosives Used in Building Tunnel

In the construction of the Otira railway tunnel, through the Southern Alps of New Zealand, more than a quarter of a million tons of explosives were used to blast the cavity and about sixty miles of copper cable were required to equip the tube for electric-locomotive operation. The engines, arranged to work singly or in pairs, get their power supply from overhead feed lines carrying 1,500 volts. The tunnel was built in two sections, boring being carried on from both ends. When the divisions met, it was found that they varied only one and a half inches from the center line established by surveyors. Each part is more than two and a half miles long and passes through rugged rock deposits. The completion of the

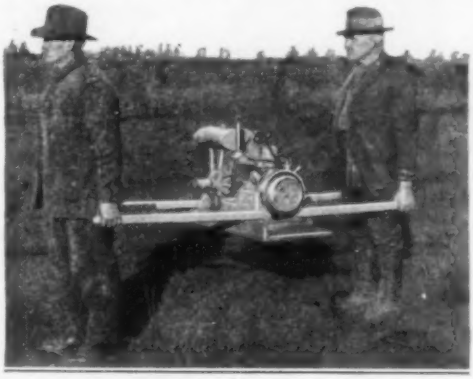


Electric Locomotive in Otira Tunnel Passing under Forest of Icicles Caused by Winter Weather

tube marks the first step in the electrification of the New Zealand railways.

Motor Pump to Fight Timber Fires May Be Carried by Two Men

For quick transportation through narrow forest trails and over wooded areas, a portable pump operated by a gasoline

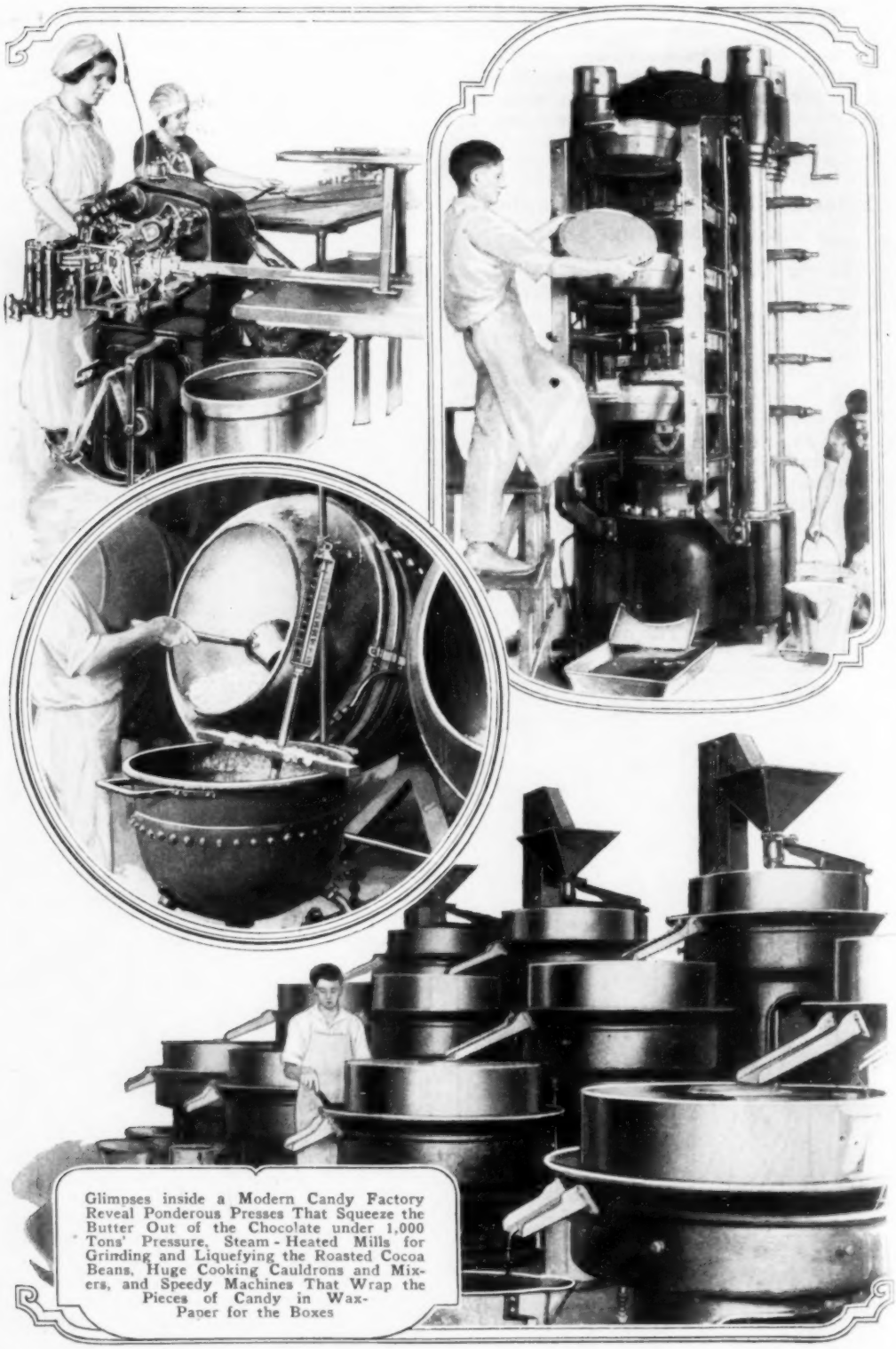


Transporting Portable Fire Pump to Aid in Fighting Blaze in Isolated Stretch of Woods

motor is being used by timber guards of New York. It is light and powerful and can draw its water supply from almost any shallow stream. When in operation, the device is said to do the work of a corps of men with shovels and buckets. Weighing only 100 pounds, the apparatus can be easily taken from place to place by two men. Three hose may be attached to the machine in case of need.

Life of Wooden Poles Is Lengthened by Chemical in Punctures

Although the practice of treating poles, posts, ties and other timbers with chemicals to prevent decay is an old one, a recent, patented improvement is said to add from fifteen to twenty-five years to the life of the wood. The apparatus consists mainly of an arrangement of forty-two independent iron bars set with sharp points which puncture the butt of the pole with rows of holes, about half an inch deep and an eighth of an inch wide, before the preservative is applied. The evenly spaced holes act as those in a sponge, soaking up the preservative and allowing it to penetrate to an equal depth everywhere in the fiber when the pole is placed in the treatment vats. According to government estimates, proper preserving of structural timbers will effect an annual saving of $72,000,000 in America. The adoption of better methods in this direction is urged not only to reduce repairing costs but also to protect dwindling timber supplies.



Glimpses inside a Modern Candy Factory Reveal Ponderous Presses That Squeeze the Butter Out of the Chocolate under 1,000 Tons' Pressure, Steam-Heated Mills for Grinding and Liquefying the Roasted Cocoa Beans, Huge Cooking Cauldrons and Mixers, and Speedy Machines That Wrap the Pieces of Candy in Wax-Paper for the Boxes

Courtesy Bunte Brothers

Display Cabinet Showing a Few of the 1,200 Varieties One Candy Factory Makes

Filling the World's Sugar Bowl

Sweet Crystals, Once a Luxury Only Nobility Could Afford, Now Are to Be Found in Every Home

FROM a delicacy that just a few generations ago was so rare that only royalty could afford it, sugar is now a familiar food article of universal consumption. At first refined from a plant that grew wild in India, production from cane and beet roots has grown to an annual output of more than 23,000,000 tons. Of this amount the United States consumes twelve billion pounds a year, enough to supply each person with 100 pounds.

Even a century ago, sugar in any form was a luxury and the granulated product was unknown. Improvements in cultivation of the cane and great advances in the art and science of refining the raw article have resulted in the manufacture of a score of different grades suited to almost every purpose. While its value as food is popularly known, sugar now enters into the industries as an aid to manufacture, becoming a vital part of many chemical mixtures and even being treated and made up into compositions from which useful articles are made.

As in early colonial days, the sap of the cane must be gathered by pressing. When extracted and crystallized, the raw product still requires melting, clarifying and filtering, but modern machinery has been developed which greatly facilitates these processes. Instruments have been devised by which the raw product can be tested for impurities, revealing to the slightest degree its content of undesirable ingredients. Although it is possible to obtain sugar from certain species of the maple tree, sorghum, broom corn, many fruits and some palms, the world's supply mainly comes from cane and beets. While the cane is generally grown in tropical and semi-tropical climates, beet sugar is a product of the temperate zones, its cultivation occupying countless thousands of acres in Europe, Canada and the United States. While it has been only 175 years since the homely beet root was discovered to contain a great volume of sugar, the Chinese are said to have known of the sugar cane nearly 3,000 years before. On one of his voyages to the New World, Columbus brought a collection of the plant for introduction to the fertile soils of the West Indies. So rapid was its spread among those islands that, in the seventeenth century, Cuba possessed

more than a hundred plantations. Today vast tracts of that country are given to the cultivation of the plant, with an output that is larger than that of any other nation. The trail of sugar cane may be said to follow the equator in a wide belt around the earth, since almost every tropical territory possesses it to some degree.

Perhaps the most popular use of sugar is in the manufacture of candies and similar confections. More than a billion pounds are consumed annually by hundreds of candy makers found in practically every city and town of the nation, and their products range from the enticing lollypop to elaborate tidbits arranged in gorgeously ornamented containers, the manufacture of which has become an industry employing many artistic designers and thousands of workers.

Experts in candy making are constantly striving to produce new and novel mixtures and forms, and ally practically every popular fruit, nut, and flavor with the indispensable sugar to attain the best effects in sweetmeats. So wide is the use of chocolate in manufacture of confectionery, that many large factories have their own refining plants where tons of cocoa beans are reduced to tasty coatings and appetizing bars, through roasting, grinding and extracting processes that alone rival the activities of the rest of industry. Giant presses squeeze the undesirable oils from the raw chocolate, which is molded in cakes for melting into coverings and mixing with other flavors, while huge vats are kept in constant turmoil by revolving blades that stir the hot masses. Coatings of chocolate are applied to the pieces in the "enrobing" room. Carefully shaped centers, traveling on an endless belt, are passed beneath a cascade of liquid chocolate flowing from raised tanks and are cooled by chilled air to harden the covering, so they may be wrapped by machine or hand before they cease their journey to grace the display counters of a "sweet shop."

In other parts of the factories, sugar is prepared into taffies, stick candies, and the more common varieties. Made into large masses of sticky, pliable molasses taffy, it is worked by a crew of white-clad "chefs" who replace the customary spoons with crowbars, jabbing, crushing and stretching it until the proper consistency is obtained.

In a single large factory, to prepare 15,000,000 pounds of sugar in more than 1,200 different forms of hard and soft candies it makes each year, 3,000,000 pounds of cocoa beans are required to produce the necessary chocolate coatings and ingredients. Milk and cream to the amount of 400,000 gallons are poured into the sweet masses that are mixed, stirred and molded by 1,500 operators. Heat, light and power are furnished by 25,000 tons of coal, while an ice plant of 300 tons' capacity insures sufficient refrigeration to keep the mountains of sweetmeats secure against melting until they are moved to the "avenue" shops.

Packing and Weighing Five-Pound Boxes of Chocolates for Bulk Shipments

Woman Inventor Gets Many Patents for Aids to Home and Office

With forty-seven patents to her credit, thirty-three of which are on the market,

Above, Convenient Memorandum for Fastening to Telephone Transmitter Showing Manner of Use

Left, Lady Inventor and Fan Guard; Above, Rubber Sponge with Pocket for Cake of Soap

Miss Beulah Henry, of Raleigh, N. C., has originated many helpful devices for home and office. Among the lady inventor's achievements is a guard for electric fans, which prevents injury from the whirling blades when moving or adjusting it, without impeding the passage of air current. Patents also have been issued to her for a rubber sponge into which a cake of soap can be inserted while in use, and a convenient memorandum chart for attaching to transmitters of telephones, where it can always be readily referred to by anyone talking over the instrument.

Flap on Plane Wing Eases Landing and Increases Lifting Power

Slower and safer landings by airplanes are said to be possible with an automatic "flap gear," by which the rear parts of the wings are hinged and pulled downward by springs when air resistance decreases or the machine is at rest. When the craft gathers speed the wind pressure on the flap adds to the lift of the wing and at the same time causes the springs to give, allowing the section to take a level position as motion is increased. Slower speeds than usual are claimed to be sufficient to keep the machine in flight, with the use of the flap, and if forced descents are necessary, the pilot can take more time to select a landing place. Owing to the effect of the gear, smaller fields can be employed for emergencies and when traveling at reduced speeds, the tail of the plane does not tip down as is the case with ordinary wings. In tests, minimum speeds for flights and landings were lessened from six to ten miles an hour under velocities required for craft not furnished with the flap gear.

Huge Pipe Is Formed with Oranges as Feature of Pageant

Hundreds of oranges of varying sizes, attached to a frame, were used to make an immense pipe that was a novel feature at a recent festival in California. From bowl to the tip of the stem, the pipe measured several feet. Darker-shaded fruit for the mouthpiece and bowl added to its attractiveness. It formed part of the coronation ceremonies attendant to crowning California's citrus queen, an annual affair of much beauty.

Pipe Formed with Oranges That Was a Novel Feature at Annual California Show

Hand Bag and Sample Case in One Reduces Packing and Luggage

So it may be used as a container for wearing apparel and small samples at the same time, a traveling bag is being made

Packing Merchandise Samples and Clothing in Hand Bag Which Has Adjustable Pockets and Cannot Sag to Crush Contents

with removable partitions that can be adjusted to form several sizes of pockets. Easy to pack, the holder keeps the contents in perfect order and cannot sag or be crushed readily. As it may also serve as a brief case, it reduces luggage necessary on short trips where documents or other valuable papers are to be carried. Constructed of heavy leather, the bag can be opened out at the top on four sides, giving great freedom for proper placing of materials when filling it.

Great Cathedral Designed by Youth Is Dedicated in England

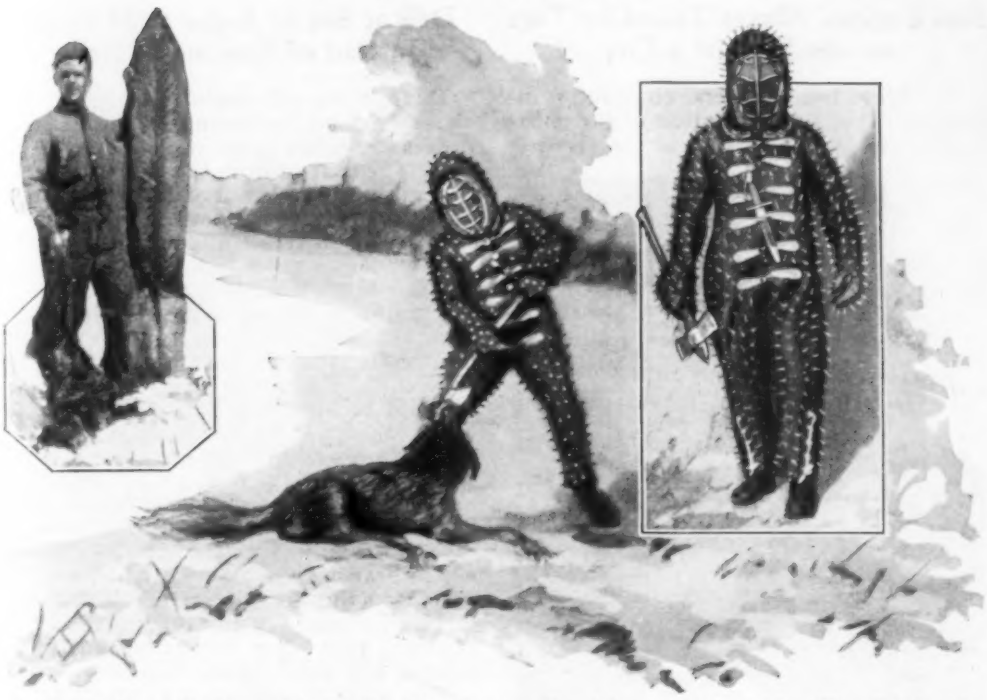
Twenty-three years ago Giles Gilbert Scott, an English youth just out of school, entered a competition for designs for Liverpool's cathedral—and won. Recently, after twenty years of work, he saw one-third of his edifice completed and dedicated, with the king and queen of England heading the notables in attendance. The work has already cost $3,600,000 and another $9,600,000 will be needed to complete it. Standing on the peak of a tree-grown quarry site on St. James Mount, overlooking the city and the Mersey river, the cathedral marks an epoch in English architecture. The two eastern transepts and the chancel, which have been completed, are 300 feet long and the chancel is 116 feet high. The immense vaulted roof is said to be the finest in England. Two similar transepts and a nave remain to be built, while a great central tower, 350 feet high, is to rise between the four transepts. The whole, when finished, will be a symmetrical structure about both main axes, and will, therefore, be more monumental, in the classical sense, than any modern cathedral. The northeast transept has been dedicated as a memorial chapel to Liverpool's war dead, with an altar and a cenotaph and illuminated roll of honor. The cathedral windows are arresting in their beauty of design and coloring and, furthermore, are remarkable for their unique grouping of modern and ancient prophets. In one group John Wesley and John Keble appear. In a group of martyrs is shown a Christian missionary killed by order of the king of Uganda. Another window depicting the activities of man shows Bach, representing a Christian musician; Lord Roberts, a soldier; and Sir Matthew Hale, a lawyer. The cathedral organ, which is nearing completion, dwarfs the organ of Albert Hall, hitherto the largest in England. It has 168 speaking stops, as compared with 114 for the Albert Hall organ.

Glasses with Square-Shaped Lenses Designed to Fit the Face

Rectangular-shaped spectacles have appeared in Germany and are said to be winning popularity, as they permit shifting of the lenses to improve the vision, and their form is considered better adapted to the outlines and shape of some faces than the regulation elliptical style.

Style of Horn-Rimmed Glasses with Rectangular Lenses Now Finding Favor in Germany

Rims of moderate width and a comfortable nose piece are points in their favor.



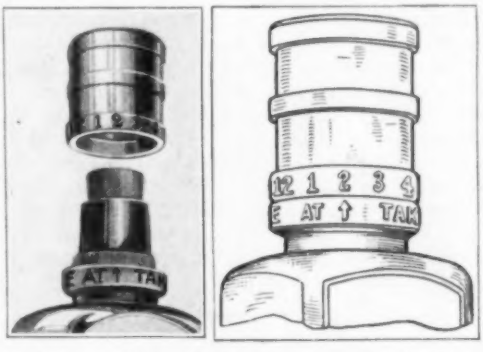
Daring Hunter as He Appeared in Bristling Spike Armor, a Pose Illustrating How Wolves Were Killed, and at Upper Left, a Trophy of the Hunt

Hunter Protected by Armored Suit Tells of Battle with Wolves

Details of one of the strangest experiments in the history of animal hunting are related by Stanley Clarkson, of St. Paul, Minn., who spent a winter in the Canadian wilderness seeking "hand to hand" combats with hungry timber wolves. Dressed in an armor made of heavy leather studded with 1,200 needle-sharp steel spikes, he invited attacks from wolf packs while armed only with a short double-bladed ax and a hunting knife. Although handicapped by an exceptionally open winter and an unusually large number of wild rabbits, which kept the wolves from suffering from hunger, he killed a number of the beasts with his ax. During a snowstorm on Steep Rock Lake, north of Atikokan, he was set upon by five timber wolves. He killed two of them and wounded a third. The wolves seized the hunter's arms and legs in their jaws, but could not do him injury because of the protruding spikes of the armored suit, which is made of specially tanned thick cowhide that will turn water and will not harden from rain or snow. There also is a helmet and heavy wire mask that can be raised to protect the face.

Bottle Cap Measures Dose, Shows Time It Should Be Taken

Fitted with a stopper that measures the doses and shows when the next one should be taken, a bottle used by the manufacturers of a medical preparation aids the patient in taking the proper amount at the correct time. The cap has numbers from one to twelve on the rim.



Bottle with Measuring Cap and Stopper Turned to Show Time of Next Dose

These are turned to a mark at the top of the container to indicate the hour that the medicine is to be taken again.

Fire Engines' Moves Traced by Tags on the Map of a City

To keep headquarters constantly informed as to the distribution of the apparatus, the fire department of Boston

Distribution Chart of the Boston Fire Department Which Indicates Exact Location of Apparatus

traces the location of each machine by means of small colored disks placed at points on a map of the city corresponding to those occupied by the equipment. Hooks on the chart designate district stations and the disks hung on them show what apparatus is assigned to the sections. Each check carries the number of the piece it represents and is colored to indicate the type. Knowing what companies answer the various alarms, the attendant in charge of the map transfers the tags to a board as the engines respond to the call. Units in the repair shops are noted on a row of hooks in a special part of the rack.

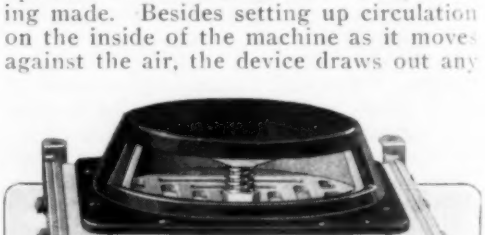
Six airplanes have been added to the equipment of the New York police to enforce the ordinance against low flying over the city, and to aid in the campaign against boats that discharge oil into the harbor and surrounding waters.

Day at Sea to Begin at Midnight Instead of Starting at Noon

Days at sea will begin at midnight like those on land, according to government orders which are to go into effect in January. The change from the customary way of figuring time on board ships, where days for ages have commenced at noon, is expected to result in confusion at first, and already opinion on the order is divided. Many old sailors point out that the world of the sea is radically different from that of the land, so it is only natural and proper that time should be recorded differently. Men who go down to the sea in ships tell time by bells while landlubbers look at clocks; seafarers go topside and below while others go up and down stairs; nautical men steer by starboard and port, except in the navy, while right and left are the guiding directions for land dwellers, and the course of the sun by which bearings are taken at sea, fits naturally into the ancient system of keeping track of time. On the other hand, it is expected that when schedules and calculations are once adjusted, fewer errors will be made in determining correct dates.

Roof Ventilation for Inclosed Cars Is Automatic in Action

To insure a supply of fresh air to the interior of closed automobiles, a ventilator to be installed in the roof and which operates when the car is in motion, is being made. Besides setting up circulation on the inside of the machine as it moves against the air, the device draws out any



Ventilator in Roof of Auto Which Keeps Air Circulating on Interior When Car Travels

impurities, and completely changes the atmosphere every few minutes, even in the largest sedans. It is easily and quickly put in place, and cannot be entered by rain or snow. The outer surfaces are finished in black or aluminum, and it is designed so as not to mar the appearance of the vehicle.

Apparently Weather-Beaten and Stained by the Storms of Ages, This Quaint Dwelling Has Just Been Completed for a California Builder Who Desired "Something Different" in Design

New House Is Built to Look as Old as an Ancient Castle

Radical departures from ordinary types of architecture are not uncommon in California cities, where builders and artists have ample opportunities to combine their skill in producing novel effects. One of the most striking examples is a high-gabled house, completed not long ago near Los Angeles. The owner desired a home that would suggest age and ruin. By clever handling of materials, the architect satisfied his client and at the same time achieved proportions and contours which blend harmoniously with the surrounding hills and country. Shielding the narrow and odd-shaped windows are cumbersome dark-stained shutters. The roof with its shingles set somewhat awry in imitation of thatching, rises to a steep peak and is apparently supported on one side by an ingenious prop anchored to a pile of cobble stones. Before the doorway is a little bridge that suggests the carefully guarded structures that spanned the moats of castles centuries ago.

¶Sufficient lumber to build fifty ordinary five-room bungalows was cut from one giant redwood tree, recently felled near Portland, Oreg.

Automatic Coin Changer Saves Time and Detects Counterfeit Money

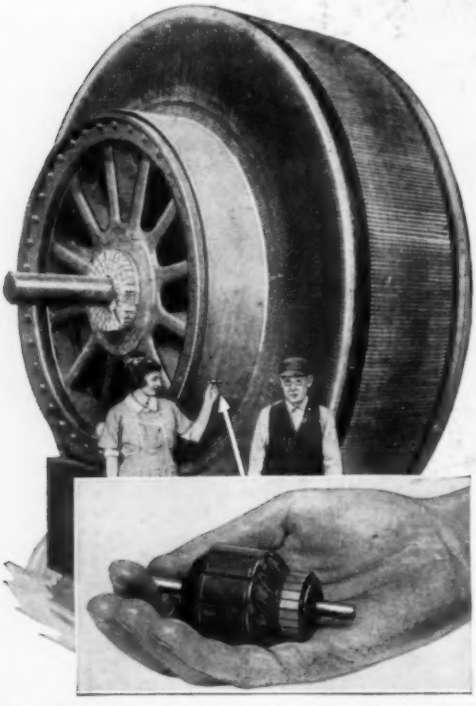
To lessen delays, automatic money-changing machines are being installed in New York subway stations. The device, which will detect counterfeit money and slugs, changes ten, twenty-five and fifty cent pieces into coins of smaller denom-

Machine That Automatically Changes Ten, Twenty-Five and Fifty-Cent Pieces into Smaller Denominations

inations. The machine was recently demonstrated and proved to be practical.

Giant Armature for Steel-Mill Power Has Copy in Tiny Motor

To show relative size of the smallest and largest types of armatures made by one concern, a six-and-one-fourth ounce wind-



How Tiny Armature for Small Blower Motor Looks When Contrasted with Forty-Eight Ton Winding

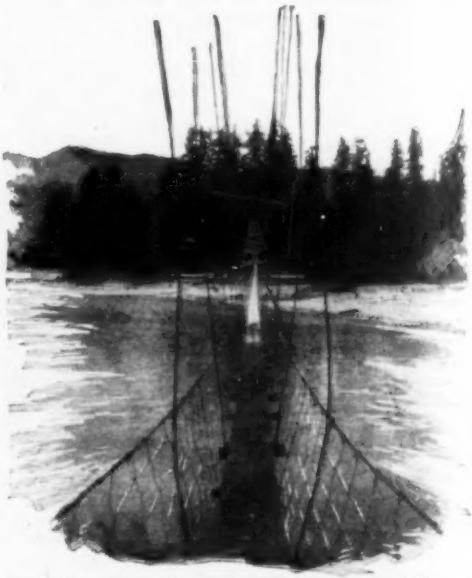
ing was contrasted with one weighing forty-eight tons. The big apparatus was built to generate power for a steel mill, while the tiny specimen is part of a motor that runs a blower. Both parts are constructed along similar principles of design and operate in much the same way. The diameter of the larger armature is thirteen feet four inches and it will revolve sixty-seven times a minute.

Steel Framework in Fireproof House Cut and Fitted on Site

Constructed entirely of fireproof materials, a bungalow in Toledo, Ohio, has a steel framework that adds to the sturdiness of the house. Cost of the metal work was considerably reduced, it is said, by devising a few standard forms from which the builders could fabricate the various sections on the site of the job. To cut any extra holes needed in the material a punch press was provided, greatly decreasing the expense required by having the steel prepared at the mill. Under the plan used, construction consisted of five steps, laying out the steel parts and punching the necessary holes for assembling, building of the steel frame, applying metal outside to receive the concrete wall, concreting the subfloor and finishing the interior. It is believed that special shapes and lengths of steel may soon be regularly made for the rapid and inexpensive fabrication of such metal skeleton work for bungalows and similar residence structures.

Trees Form Piers for Footbridge across Wide River

Swung between big trees that grow on both sides of the Quinalt river in Washington, a narrow suspension bridge, about 1,000 feet long and but two feet in width, affords foot passage over the stream. Said to be the longest structure of its kind in the world, the span, supported at the land ends by forest giants, is secured in the middle to a pier fifty-four feet high resting on a "mat" of rocks and tree branches, a foundation made necessary by the continual changes in the river channel. Heavy cables are stretched on each



Footbridge Swung between Trees on Banks of River to Give Passage from Waterlocked Farmland

side of the bridge to prevent swaying, while the platform is protected by high wire netting for safety of pedestrians.

Group of Sociable Pelicans Pluming Themselves after a Dip in the Pond

Feeding the Animals in a Zoo

Costs Nearly as Much to Feed a Sea Lion as an Elephant, and the Lions and Tigers Outeat the Hippopotamus

IT costs almost as much a day to feed a sea lion in captivity as it does to satisfy the hunger of an elephant. A ton or so of first-class hippopotamus costs less for upkeep than a lithe Bengal tiger or a tawny, sleepy-eyed lion from Africa.

The reason whereof is the difference in their diet, and the diet kitchen of a zoological garden can tell you these and many other strange and interesting facts about the feeding of captive birds and animals.

The daily order of "groceries and meats" for the Lincoln Park zoo in Chicago includes more than thirty different kinds of food, ranging from hay for the elephant, buffalo herd, zebras, gnu and zebu, or sacred cattle, through meat and fish for the carnivorous tribes, to eggs, oranges, apples, carrots, celery, onions, Mellin's food, cod-liver oil, olive oil, bananas, milk, bread, and, occasionally, pills for stomach ache and other disorders.

The zoo's bill for feed for its 239 animals and 758 birds, amounted to $17,356.62 last year, according to Albert E. Parker, the director. Only the best of everything is purchased, and extreme care is used in its preparation to guard against the myriad ills which beset animals and birds, especially in captivity.

When they do get ill, Parker treats them homeopathically, for their symptoms rather than the disease. The reason is that the same disease rarely hits two animals in the same way. The chimpanzee in one cage may have chills with his pneumonia, and his mate in the adjoining hospital ward will take his pneumonia with fever. The success of Parker's method of doctoring is attested by the fact that "Toto," the big chimpanzee, has come safely through three sieges of pneumonia — two more than most monkeys ever survive.

Medicine for the animals comes under the head of food because it is administered with the meals. Getting six feet of squirming tiger to swallow a nerve pill is a difficult task, but if the pill is hidden in a lump of lard and the lump then concealed

Twenty-Three Feet of Python from India; This Nervous Reptile's Meals Consist of Plenty of Ground Meat Fed to the Snake with a Sausage-Stuffing Machine

Catering to the Tastes of a Zoo Family Calls for Everything from Hay to Honey

Daily Fish Courses Compose the Diet of the Quaint Penguins Whose Habitual Foraging Grounds Is the Sea, near Which They Settle in Great Colonies among Rocky Ledges

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Graceful Rose-Tinted Flamingoes Lunching on a Bucket of Feed Served from the Zoo's Larder

Where the Bottle Is Mightier than the Trap; a Forest Ranger Treating a Young Bear to a Drink of Honey and Water. Right, Pouring Food into a Cobra through a Bone Pipe Inserted in the Serpent's Mouth

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Cinnamon Bears Performing Clownish Antics in Their Zoo Den to Persuade Rewards of Fruit and Candy from the Host of Amused Visitors. Left, Mother Kangaroo Indulging in a Noonday Feed; Her Youngster Safely Tucked in Her Pouch Partakes of a Few Morsels Overlooked

Butcher Shop of the Animal House Where Choice Meats Are Apportioned to Hungry Captives

Young Pet Orang-Utan Enjoying a Milk Repast; Below, Master of the Zoo, the Lordly Lion Awaiting a Visit from Its Keeper

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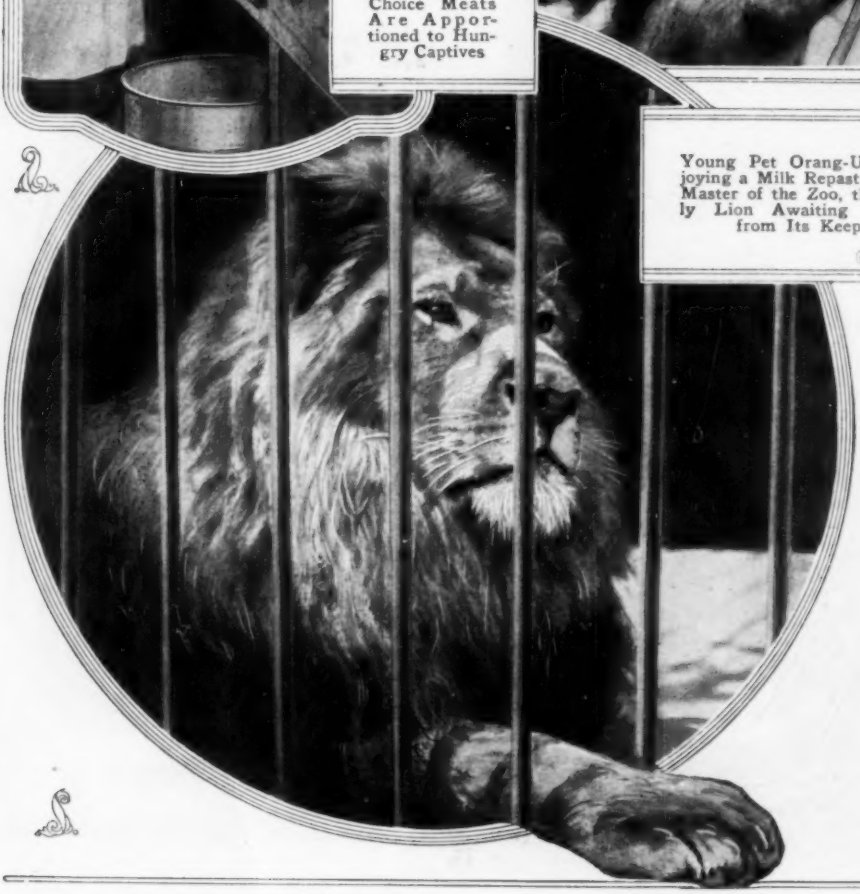
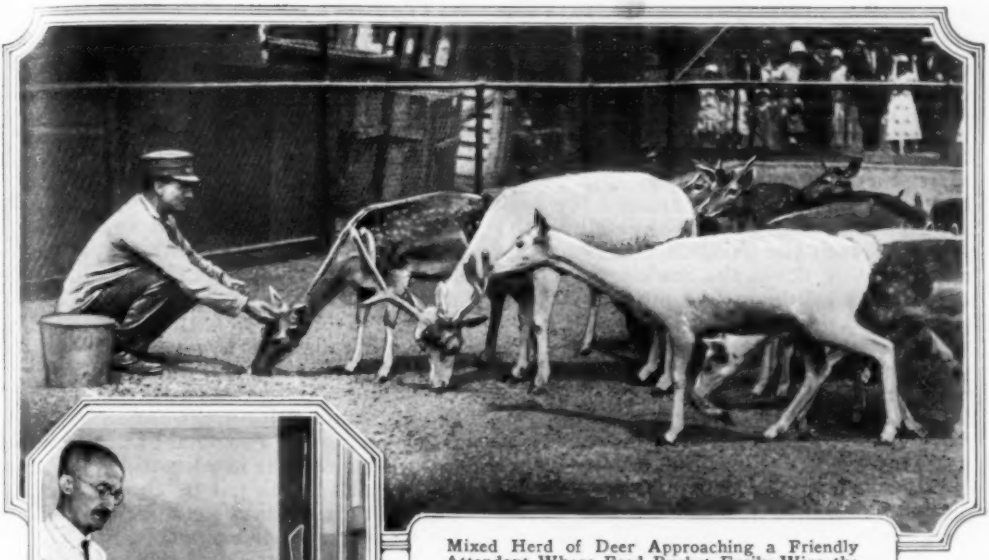
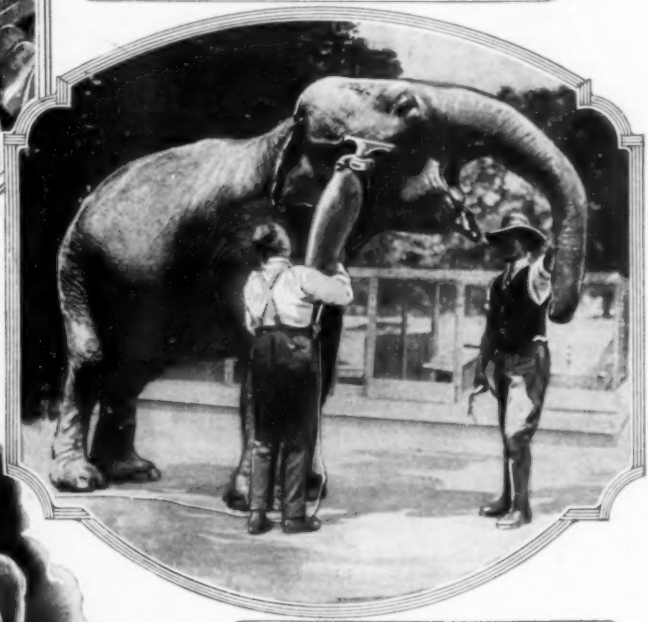




Mixed Herd of Deer Approaching a Friendly Attendant Whose Feed Bucket Easily Wins the Animals' Attention. Left, Pure, Sweet Milk Rationed Out by the Gallon for Old and Young Inmates of the Zoo



Modern Vacuum-Cleaning Methods Applied to "Jumbo's" Hide Are Enjoyed by This Elephant Which Gets a Daily Sweeping to Keep It Neat. Left, "Bottle Baby" Walrus Taking a Meal from Its Watchful Keeper Who Cares for the Ugly Youngster's Every Want

in a nine-pound piece of meat, Mr. Tiger takes his medicine without knowing it.

The big eaters of the zoo are not the most expensive ones. A prime young elephant thinks nothing of tossing down from 75 to 125 pounds of hay in a day and then finishing off on a bushel or so of peanuts contributed by children. Hay, however, is relatively cheap, and the park concessionaires grow wealthy selling the peanuts which the children contribute toward keeping down the zoo's food bill.

The food bill begins to mount, though, when a full-grown male tiger gulps down nine pounds of best beef, while even the youngsters take their five-pound chunk every day but Sunday. Sunday is fast day for all the big cats, the one-day-in-seven rest keeping them in good health.

A big male lion takes six pounds of beef on weekdays, and his mate a four-pound piece. Leopards and the smaller members of the cat tribe, including the American puma, or mountain lion, get along on from two and one-half to three and one-half pounds for their one meal a day.

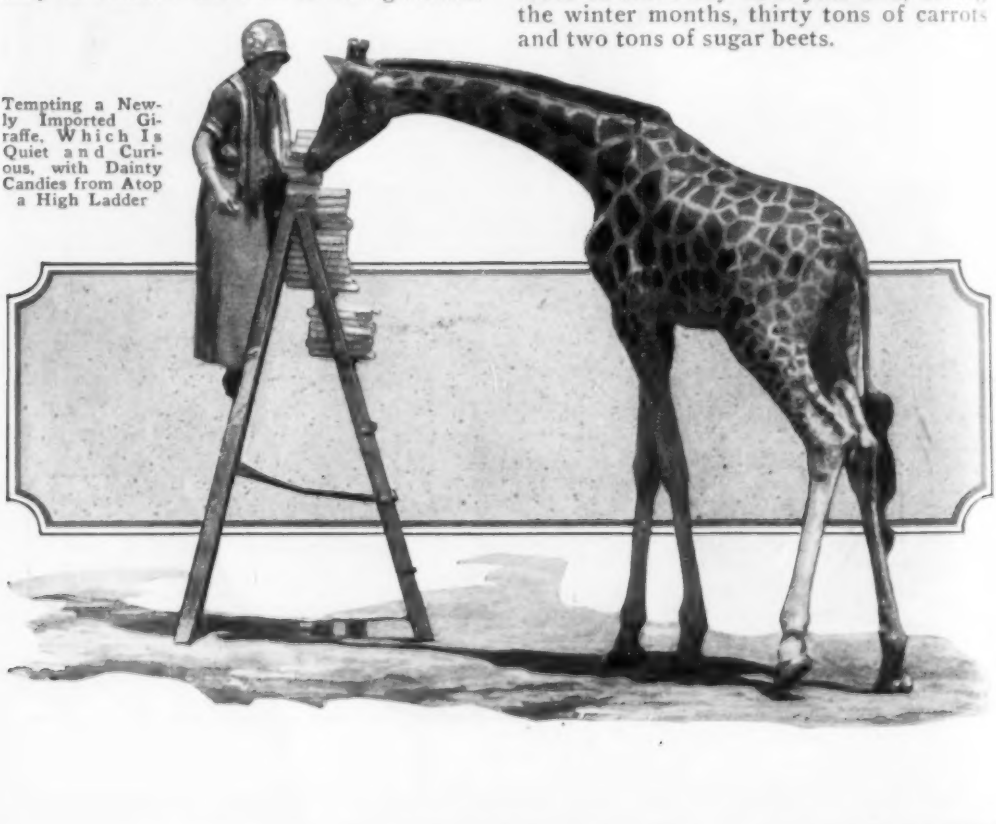
A quarter of beef is delivered to the zoo each weekday morning and is immediately cut up by the butcher, who lays the pieces out on a table to get warm before the four p.m. feeding hour. The carnivora like their meat warm, and it is necessary to remove the chill of refrigeration.

The sea lions are fish eaters, and get their five pounds every day, including Sundays. At feeding time, they contribute a special program of diving, climbing and swimming for the benefit of the spectators, getting one fish for each stunt. The sea lions are the best time tellers in the zoo and regularly at fifteen minutes before feeding time one mounts his lookout perch on the rocks to announce the coming of the waiter with his basket of fish. At the hippo den, two bushels of mixed feed a day will keep the doctor away. The hippo's mixture includes apples, bread, bran, hay, crushed oats, carrots and other vegetables.

The bears get a varied diet, with fish for the big white polar bears and bread as the mainstay for the rest. All of them supplement their regular meals with peanuts and crackerjack furnished by the visitors. A bear will eat so many peanuts in a day that his regular rations are cut in half on Saturdays, and omitted entirely on Sundays.

The birds and the monkeys are the most particular eaters in the zoo. The big pelicans get a pound and a quarter of fish a day, and the eagles, hawks and vultures take the same diet.

Part of the zoo's food bills include 150 loaves of bread weekly for the bears, birds, young deer and kangaroos; six carloads of baled hay each year and, during the winter months, thirty tons of carrots and two tons of sugar beets.



Tempting a Newly Imported Giraffe, Which Is Quiet and Curious, with Dainty Candies from Atop a High Ladder

Damage by Smoke in Twenty Years Equals Century of Decay

In the last twenty years, Westminster Abbey has suffered almost as much damage from smoke as time inflicted in all the previous 650 years of the building's existence, according to the reports of engineers. Even some of the new stones used to repair it a score of years ago have begun to crumble, indicating that much of the cathedral's decay has been caused during the last half century. The city of Manchester also reports heavy damage from smoke. To combat the evil, authorities in England have been urging the substitution of gas wherever possible and this is believed partly responsible for a decrease in the death rate, by reducing smoky fogs favorable to the development of bronchial and tubercular diseases. In Glasgow, the amount of gas used during 1901-20 rose from 5,500,000,000 to 8,000,000,000 cubic feet and during the same period, the death figures fell from 21.2 to 15.3 per thousand.

Tennis Courts Are Made of Roofing

Because rains prevented tennis playing by leaving clay courts too soft for use until they dried, a St. Louis club surfaced its grounds with asphalt roofing. The covering is said to give a better footing to the players and to permit games within a short time after rainfalls. The sheeting is easily and quickly applied and held flat in place by cement. Besides insuring a uniform court surface the year around, the material is said to withstand rough usage. Requiring little expense for upkeep, the roofing is said to greatly increase the number of games during a season.

Japanese School Ship Recalls Days of Canvas-Rigged Craft

With acres of canvas spread to the wind, recalling the romantic age of sailing vessels, the barkentine "Shinkoku Maru," training ship for officers of Japan's merchant fleet, recently completed its maiden voyage. Regarded as among the finest craft of its class afloat, the school ship is commanded by one of that country's most noted sailors. During a period at sea, the student-officers are taught management of crews and administration of almost every type of merchant vessel, under the instruction of veteran seamen. On its first cruise, the barkentine carried a class of sixty cadets.

With Full Canvas Spread, the Japanese Training Ship Gliding Swiftly through the San Francisco Bay on a Visit during Its Maiden Voyage

¶Dried mushrooms constitute one of Poland's most important exports.

Gas Masks for Mail Clerks to Foil Attacks of Train Bandits

To defeat the attacks of gas-bomb-throwing bandits who already have invaded Uncle Sam's mail cars, the government proposes to equip clerks with masks as protection from the poisonous fumes. The hoods are to be purchased from the war department under plans discussed by officials and are to be the same type that were used in the trenches during the World War.

Copyright, Henry Muller

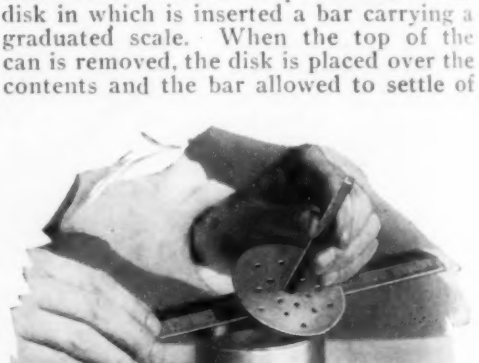
Shielded by Gas Mask and Armed with Revolver, Mail Clerk Ready for Bandit Attack

Cure for the Terrors of Childhood Is Sought by Scientists

Fear of the dark, of snakes and many other terrors common to childhood are usually acquired and are not inherent, according to deductions drawn from experiments that have been performed on a number of children by investigators of the teachers' college at Columbia university. They have been trying to discover ways to combat some of the distressing mental agonies that the child frequently suffers and that often warp the life in later years. Most of these fears, it is believed, are entirely unnecessary, being acquired from bogey-man tales and environment. Their existence is often a sign of some lack in the parent. Repeated experiments showed that children under two years old had no sign of fear of fire or darkness. A snake was shown to fifteen small children. Seven of them, from fourteen to twenty-seven months old, betrayed no fear at all, eight evinced guarded reactions and two were afraid. Some of the youngest ones tried to pick up the snake and play with it. Ways were discovered to break down some of the childish fancies. For instance, a baby boy that had a dread of anything resembling fur was cured of his fear by having animals about when he was fed. A lump of sugar was given to him and an animal was brought near at the same time. Gradually, he associated the two, his love of the sugar overcoming his fear, and he finally laughed at white rats and played gleefully with a badger rug, head and all.

Amount of Liquid in Can Is Shown by Disk and Metal Bar

Accurate measurements of the amount of liquid contained in a can of fruit or other foods are easily and quickly made, without emptying the container, by means of a gauge devised by a government scientist. It consists of a perforated metal disk in which is inserted a bar carrying a graduated scale. When the top of the can is removed, the disk is placed over the contents and the bar allowed to settle of its own weight to the solid matter. By placing a ruler or other straight edge across the top of the can and reading the scale shown on the bar, it is possible to tell the proportion of liquid the can contains. It is proposed to devise a standard scale for each kind of food as the proportion of liquid varies with the character of the contents.



Measuring Proportion of Liquid Content of Can with Graduated Bar Gauge and Ruler

Summer Bungalow Entirely Covered with Shingles of Newspapers Which Were Folded Flat and Glued

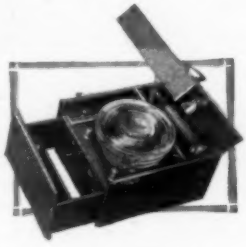
Bungalow Built of Old Newspapers Is Thoroughly Weatherproof

Constructed of old newspapers, pressed flat and glued, a bungalow built at Rockport, Mass., serves as a cozy summer home for the family of its owner. Both inside and exterior of the dwelling are composed of the paper "shingles" which have been heavily coated with waterproof varnish. The news pages were first folded tightly into regular-size squares and treated with glue to keep them flat and stiff. The newspaper lumber was easily attached to the wooden framework with ordinary shingle nails. The structure was erected by three members of the family, and besides presenting an attractive appearance, was less expensive than those of ordinary materials.

Nailing the Paper Lumber to the Wooden Frame

Portable Tank for Goldplating Uses Two Dry Cells

To enable jewelers, dentists and other manufacturers of small metal articles to goldplate their products quickly and cheaply, a portable plating tank is being made that does its work in from seven to ten minutes. Weighing only eight and a half pounds, the outfit is equipped with small batteries to supply current and applies a substantial coating of gold on almost any metal object it can hold. The veneering is of such a nature, it is said, that it takes a lasting polish simply by being rubbed dry after removal from the solution.



Ships Sunk by Ocean Monsters

While wrecks at sea caused by collisions with whales may seem fantastic, there are several records of such accidents. One of the most disastrous was the wreck of the whaler "Essex" that went down in the Pacific ocean, 2,000 miles from land, after striking a huge sperm whale which rose to the surface in front of the ship's bow. The monster, enraged, swam away a short distance, then returned at terrific speed and deliberately rammed the vessel. Only one of the lifeboats with a few of the crew reached safety. The pilot ship "Bonita," several years ago, also was sunk by a whale which was traveling at great speed. A few days later, a whale, thought to have been the same that smashed into the "Bonita," collided with a large steamer in San Francisco bay. In 1900, a whale was mortally wounded when it struck the sharp cut-water of a steamer. It has been said that the animals in charging ships do so because of an impression that the vessel is another whale.

One of the Coast-Charting Steamers That Ply Unknown Seas about the Shores of the Frozen North, Beating New Trails to Safeguard Ocean Traffic through Tortuous Channels

Charting Waters of the Frozen North

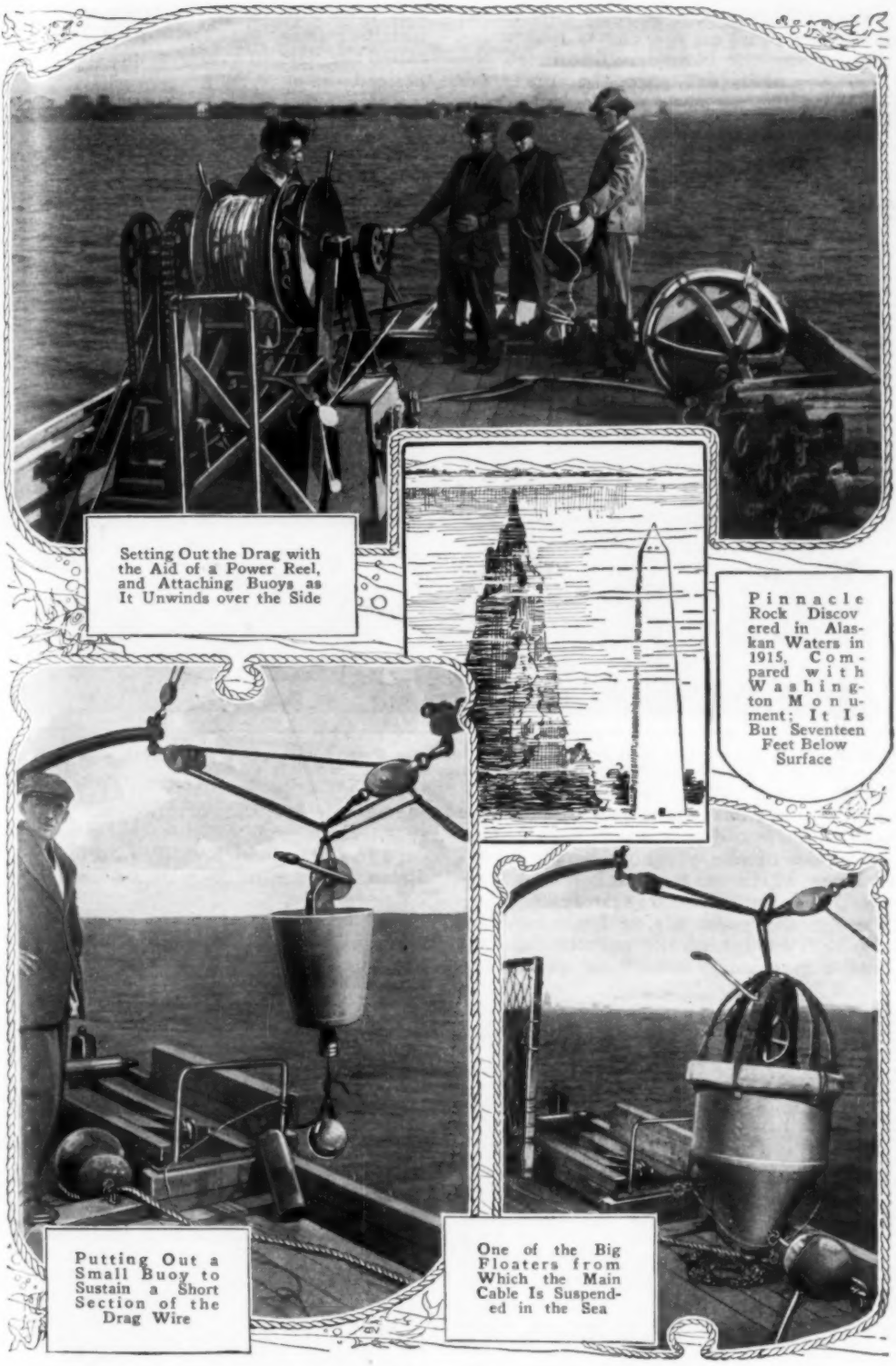
Intrepid "Scouts of the Oceans" Search Hidden Depths for Rocks, Ledges and Bars That Menace Navigation

THAT men may go down to the sea in ships and come home to port again unharmed by the jagged formations that infest the waters about Alaska, the United States coast and geodetic survey is charting an inside route and the coast line of that peninsula.

Industries are springing up constantly and the commerce of the territory is becoming an extremely important one, depending almost entirely upon the development of shipping between those often frozen-in shores and the rest of the world. Until the seas contiguous to the country have been fully and completely charted, considerable risk attends attempts to navigate those waters that remain unsounded and unmapped.

Far longer than the combined coast lines of the Atlantic and Pacific sides of the United States, Alaska's shore line, if detailed and extended, would reach around the world at the equator. To thoroughly feel out every foot of sailing ground, measuring jagged pinnacles that rear their needlelike points to within a few feet of the surface, and to sound the shallows requires not only expertness, but also a lack of fear that challenges the tortuous courses winding between rugged mountain sides which sometimes drop from dizzy heights to the water's edge and continue unseen in a forest of massive peaks that stretch across navigable channels just far enough below the surface to escape the wary eye of the mariner.

To reveal the presence of such obstructions, the charting crews sweep the waters with a wire drag stretched between buoys that are towed by small ships. When it strikes an object, a signal instantly warns those on the boats, who apply to the barrier measuring instruments and apparatus that register the approximate shape of the obstacle. Its location is then set down on the chart, a standard symbol representing its exact nature. A deviation of the slightest part of an inch from the true position on the map may result in untold future hardships to sailors, who



Setting Out the Drag with the Aid of a Power Reel, and Attaching Buoys as It Unwinds over the Side

Pinnacle Rock Discovered in Alaskan Waters in 1915, Compared with Washington Monument; It Is But Seventeen Feet Below Surface

Putting Out a Small Buoy to Sustain a Short Section of the Drag Wire

One of the Big Floaters from Which the Main Cable Is Suspended in the Sea

follow faithfully the network of contour lines and signs on the charts that guide them along the courses. But in all the 104 years of its existence, the survey department has not had one accident attributed to inaccuracy of its records.

In plotting the seas, the wire drag is allowed to swing at about a hundred feet beneath the surface, not only to cover the depth of the ordinary ship's hull, but to take care of the probable need of submarines which at any time may be ordered to cruise these seaways. Commanders of vessels plying northward are reluctant to hazard the narrow channels until the sounding craft have picked the way ahead or swept the lanes with their unfailing drags. These consist of a wire called the bottom cable, maintained at any desired distance below the surface, and weights suspended by lines attached to floating buoys. This "feeler" is made up in hundred-foot sections and can be added to from time to time to conform with the profile of the ocean floor at any spot. Even small obstructions cannot escape the drag, which easily informs those above of the presence of peaked rocks, bowlders, sharp ledges and coral formations that might prove a menace to shipping and an impediment to commerce but for the safe guidance of charts.

How Hidden Obstructions That Menace Ships at Sea Are Found by Dragging the Waters with a Wire "Feeler" Which Signals the Surveyors When It Strikes an Obstacle

Eye Tests Proposed for Autoists to Reduce Motor Mishaps

That about half of all automobile accidents are due to faulty eyesight is reported by the California league for the conservation of vision. Only two per cent of the accidents in that state were attributed to defective brakes, while approximately twenty-five per cent were said to have been caused by speeding or recklessness. Similar findings are reported from Cleveland and Detroit. As an additional safety measure to reduce the number of motor mishaps, park officials in a large western city have proposed that all persons be required to pass rigid optical examinations before they are allowed to operate cars. It is pointed out that this would weed out color-blind persons likely to go blundering past light signals and would detect all those who by reason of extreme far or nearsightedness or night blindness would be considered unfit to handle a steering wheel. Legislation along this line in Massachusetts is already said to have reduced the number of automobile accidents by half and equally good results are predicted if all motorists were required to pass physical and optical tests such as are now given by most taxicab companies to prospective drivers.

Railway Don'ts for Men's Watches Keep Timepieces Accurate

When passenger trains run in and out of terminals on one and two-minute headways, and fast mail trains and heavy freights thunder along the right of way, the time on which they run must be accurately maintained. To accomplish this every road has devised a system that extends to all the clocks on its lines and which reaches down and touches the balance wheels of the watches carried by employes. These watches must be inspected regularly and cleaned at least once in eighteen months. One road recently issued a bulletin advising its men to wind their watches at the same time every day, preferably in the morning, and to see that they occupied the same relative position at night as during the day and were not subject to any great temperature changes. No watch is permitted to vary more than thirty seconds a week.

Time Is Saved in Typing Postcards That Have Flap for Address

Loss of time caused by having to reinsert an ordinary postcard into the typewriter for the address after the message is written, has been eliminated in a new style of card invented in Germany. It carries a flap about an inch and a half wide at the bottom for the name, and both message and address are typed without taking the card out of the machine. Afterward, the flap is

Postcard with Flap on Which Address Is Written, Folded Back Ready for Gumming

folded over and secured to the card by moistening the gummed underside. The address thus appears right side up, and there is no danger of writing the wrong name as the typist has both card and address in full view.

Flexible Spout Serves as Funnel on "Gas" or Oil Measure

Combining a measure, strainer and funnel all in one, a can designed for use in filling automobile gasoline tanks or crank-

Filling Automobile Gasoline Tank without Using a Funnel from Measure That Strains Its Contents

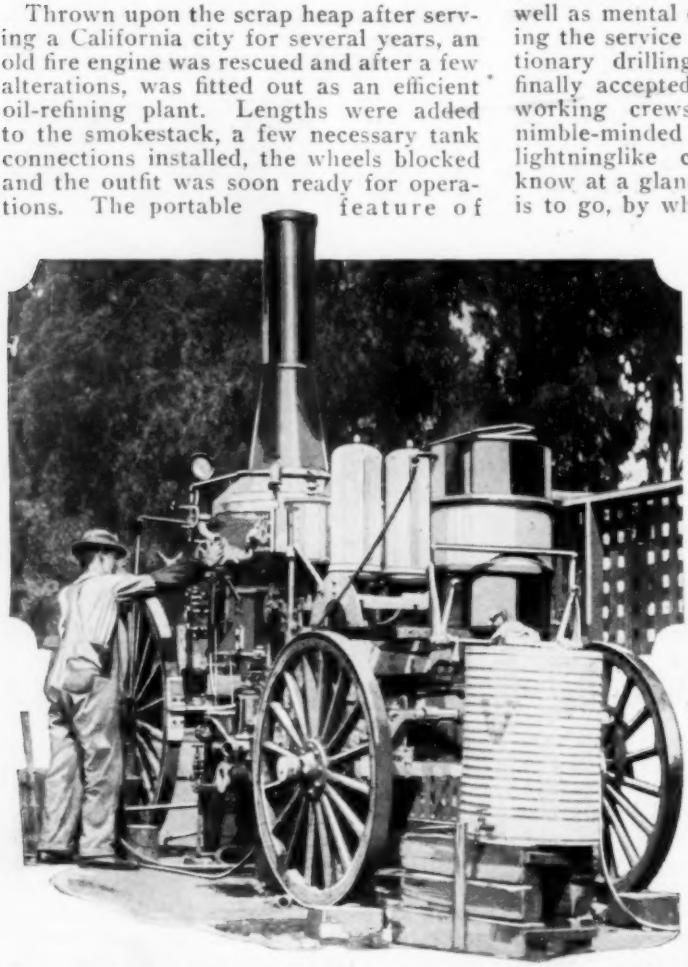
cases easily, quickly and without waste, is being manufactured. Equipped with a flexible metal spout that can be placed in any position, a strainer and a thumb lever that controls the flow, the gasoline or oil may be poured directly into any container without the use of a funnel. A spring keeps the valve on the spout closed unless opened by the lever. To prevent dripping when not in use, a hook holds the metal hose up against the measure.

Emeralds and Rubies Are Valued More Highly than Diamonds

Despite the value of perfect diamonds, their price is greatly exceeded by flawless emeralds of equal size and weight, according to experts. Generally the green stones are liable to cracks and "faults" which reduce their value, but this fact, it is said, makes the perfect ones almost priceless. The best stones are now found in Colombia and Venezuela. A number of rings claimed to have been made in the days of Cleopatra and carved with her portrait are in existence. Rubies of good quality are also more highly prized than diamonds, but unflawed specimens are rare.

Abandoned Fire Engine Remodeled into Oil-Refining Plant

Thrown upon the scrap heap after serving a California city for several years, an old fire engine was rescued and after a few alterations, was fitted out as an efficient oil-refining plant. Lengths were added to the smokestack, a few necessary tank connections installed, the wheels blocked and the outfit was soon ready for operations. The portable feature of the equipment was found desirable, as the whole plant was easily hauled from place to place.



Discarded for Motor-Driven Equipment, Gallant Old Horse-Drawn Fire Engine Remodeled, on Duty as Oil-Refining Plant

Great Skill Shown by Mail Clerks in Distributing Letters

Standing at ease twelve feet from mail racks or pouches, expert postal clerks distributing thousands of letters and packages a day can toss parcels into their proper compartments without appearing to raise their eyes from the rapid work of scanning the addresses. Some of the workmen in post offices of large cities can throw the matter accurately from almost any position, using the overhand, underhand or side-arm motion. The men chosen for this task are subjected to physical as well as mental examination and on entering the service must go through a probationary drilling period before they are finally accepted as members of the fast-working crews. With each toss the nimble-minded clerks accomplish some lightninglike calculations. They must know at a glance where a piece of matter is to go, by what route it must travel to reach its destination, and the time of departure for trains, boats, trolley cars, auto trucks and airplanes, all of which transport the tons of mail daily received and sent out by the post offices of the nation. In New York, for instance, "outside" mail is separated by states and then turned over to the railroads, where clerks continue the process of sorting it into pouches for cities, towns and hamlets, while it is speeding toward its destinations. It is estimated that at most a letter passes through about fifteen handlings between the time it is mailed and its delivery.

Clog-Proof Drain Absorbs Water

Made of porous material through which water can pass to the interior, drain pipe being manufactured has no opening to admit dirt, leaves and particles of soil. Laid along roadways or in marshy ground it absorbs moisture through its sides and conducts it rapidly from the area. Because no channels are necessary at the edges of highways equipped with the tubes, more space is permitted for traffic, and dangerous ruts due to rainfall are prevented, eliminating the hazard of ditching vehicles. Claimed to be frost-proof, the pipe is said not to be expanded or damaged by freezing weather, and also to carry off a volume of water several times the capacity of ordinary drains. It will quickly dry up swampy lands and prevent effects of washouts in the neighborhoods of railway cuts, canals and similar localities.

"Upkeep Cost" of Shoes Is Reduced by Detachable Heels and Soles

Shoes with detachable soles and heels that, it is claimed, cannot rip off and that anyone can put on in a few moments have been patented by an eastern inventor, to cut repair bills and to obtain full service from the uppers. The parts are held by tapered screws inserted from the inside of the shoe through holes in the inner sole and the fringe of the upper that overlaps it. Tapered nuts attached on the outside sole bind the layers together. Either rubber or leather heels are used and, with the soles, may be renewed as often as desired. They can be used with tan, brown or black shoes and fit tightly to exclude water. A handy screwdriver wrench for attaching them is provided, and both screws and nuts have flat tops so that they leave a smooth surface on the inner and outer sole. The soles are also said to be more flexible than the ordinary style, and the shoes more easily "broken in."

Auto Hitched to Street-Car Trailer Hauls Freight and Passengers

Freight and passengers both are hauled and an abandoned street-car line is put to good use in Amsterdam by an ingenious combination "train" composed of a motor truck and a surface-car trailer. Packages of farm products are carried in the former, while persons ride in the trolley car. A fair rate of speed is developed and economy of operation is claimed for the line, which serves an outlying district.

Electric Motor Pump Feeds Sick and Aids Use of Serum

To help physicians in giving quantities of liquid nourishment to patients, injecting serum into the veins and in operations

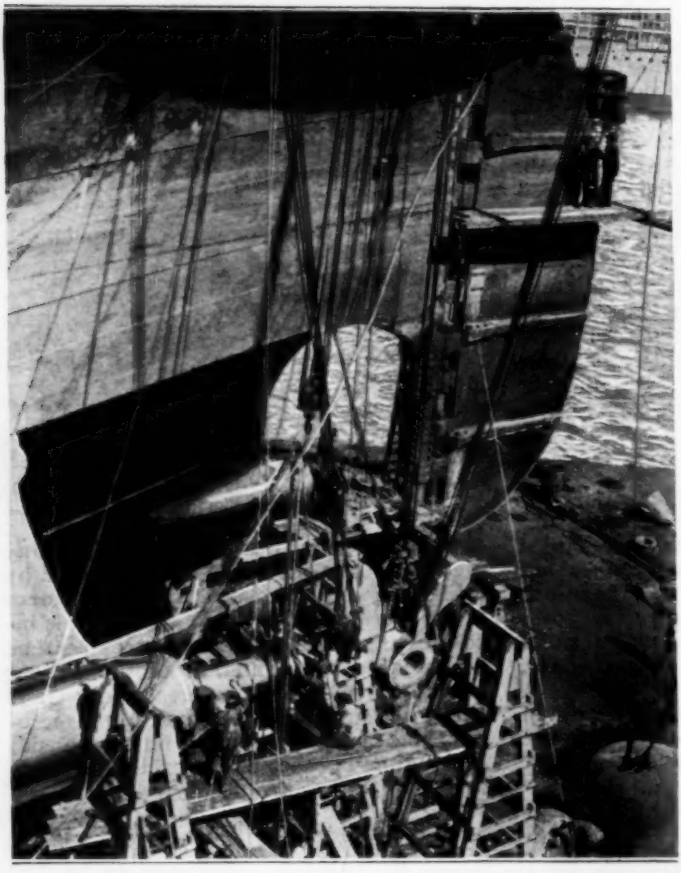
Inventor and Motor-Pump Syringe for Injecting Quantities of Serum and Liquid Nourishment

that require transfusion of blood, a tiny electric motor pump has been invented by William Gaertner of Chicago. The instrument operates a syringe to force liquids into the system. Its speed and stroke can be adjusted to the condition of the patient and to various kinds of treatment. It is said to be more accurate than other methods, and saves doctors and nurses considerable time in cases where prolonged feeding or injections are necessary.

Motor-Bus Street-Car "Train" with Its Trolleyless Passenger Trailer on Track

Drydock Lifts 46,000-Ton Liner Forty Feet for Repairs

The greatest British-built liner, the "Olympic," holds the honor of being the first big ocean vessel to be repaired in the world's largest floating drydock, recently opened at Southampton by the Prince of Wales. The huge dock raised the ponderous 46,000-ton liner forty feet in three hours and forty-five minutes, furnishing a dry platform on which the ship's bottom could be overhauled. Some idea of the size of the ship can be gained from the comparison of the men in the foreground with the new propeller which they are slipping into place. The "Olympic" was not an especially big burden for the dock, for it was built to handle 60,000 tons, sufficient to take care of the 56,000-ton "Majestic," German-built but British-owned since the war. The "Majestic" is virtually the same size as the "Leviathan."



Slipping a New Propeller into Place on the Steamship "Olympic" after It Was Raised from the Water by the Giant Drydock

The dock is 960 feet long, as compared to the "Majestic's" 956 feet, and has a clear inside width of 131 feet, while the "Majestic's" beam is 100 feet. Provision was made in building the dock for the addition later of another middle section, enabling it to handle a larger vessel. Any two of the sections can be detached and self-docked in the remainder, so that the dock can "repair itself." The dock is moored to concrete dolphins on the shore with four huge steel booms, the tops of two of which form gangways for men passing back and forth between shore and the dock floor. Traveling cranes run on top of the sides of the dock, and flying gangways at either end can be opened while a vessel enters the submerged dock, and then closed after the lift to permit workmen to travel from one side to the other. The dock is so big that after the Prince of Wales, who officiated at the christening, had pulled the lever and submerged it, the official party boarded a good-sized ocean-going ship, which steamed through the dock.

Mercury Is Turned into Gold

Have the dreams of the alchemists been realized? This possibility is seen in reports from Berlin announcing that gold has been produced from mercury through which an electric current had been passed from twenty to 200 hours. The discovery was made in the laboratory of Prof. G. R. R. Miethe, of the Berlin technical high school. A quartz mercury-vapor lamp was used and after the experiments a small quantity of gold was found in the black deposit in the lamp. Careful investigation showed that there was no precious metal in the mercury used in the construction of the lamp and that its appearance was accounted for by the disruption of the atoms of the mercury under the prolonged electric current.

Model of Cathedral Carved in Wood Shows Maker's Skill

With a small hand scrollsaw and strips of wood, a Los Angeles craftsman, after hours of painstaking labor in his spare time, has completed a miniature of the famous Ulm cathedral in Wurttemberg, Germany. Proportions and rich decorations of the majestic spire of the edifice, which in reality is 528 feet high, taller by twenty-one feet than the graceful twin steeples of the Cologne cathedral, have been accurately reproduced, as have the flying buttresses, lattice windows and other parts of the building. The model stands nine feet high.

Vulcanizer Prevents Leaks in Roofs and Waterproofs Concrete

For waterproofing concrete surfaces and laying roofs that will not leak, a portable electric vulcanizer has been patented. It is designed to be used with the ordinary lighting current or with a special generator, and consists of a roller with shoe and trowel-like parts, which, when heated to a high temperature and run over the surface, effectively weld layers of felt or paper roofing mixed with asphalt firmly to the roof boards. The vulcanizer also irons out wrinkles in the material and prevents the formation of gas and air blisters, which commonly develop after certain kinds of roofing have been applied in the ordinary manner, and burst open causing leaks which may necessitate costly repairs. The heat is controlled by thermostats and the vulcanizer can be used satisfactorily in mending asphalt pavements, laying various kinds of composition flooring and for applying felt and tar mixed with crushed rock over old shingle roofs.

Waterproofing a Concrete Floor by Applying Composition and Treating It with Portable Electric Vulcanizer

Auto Carbon Is Removed by Brush Operated by Electric Motor

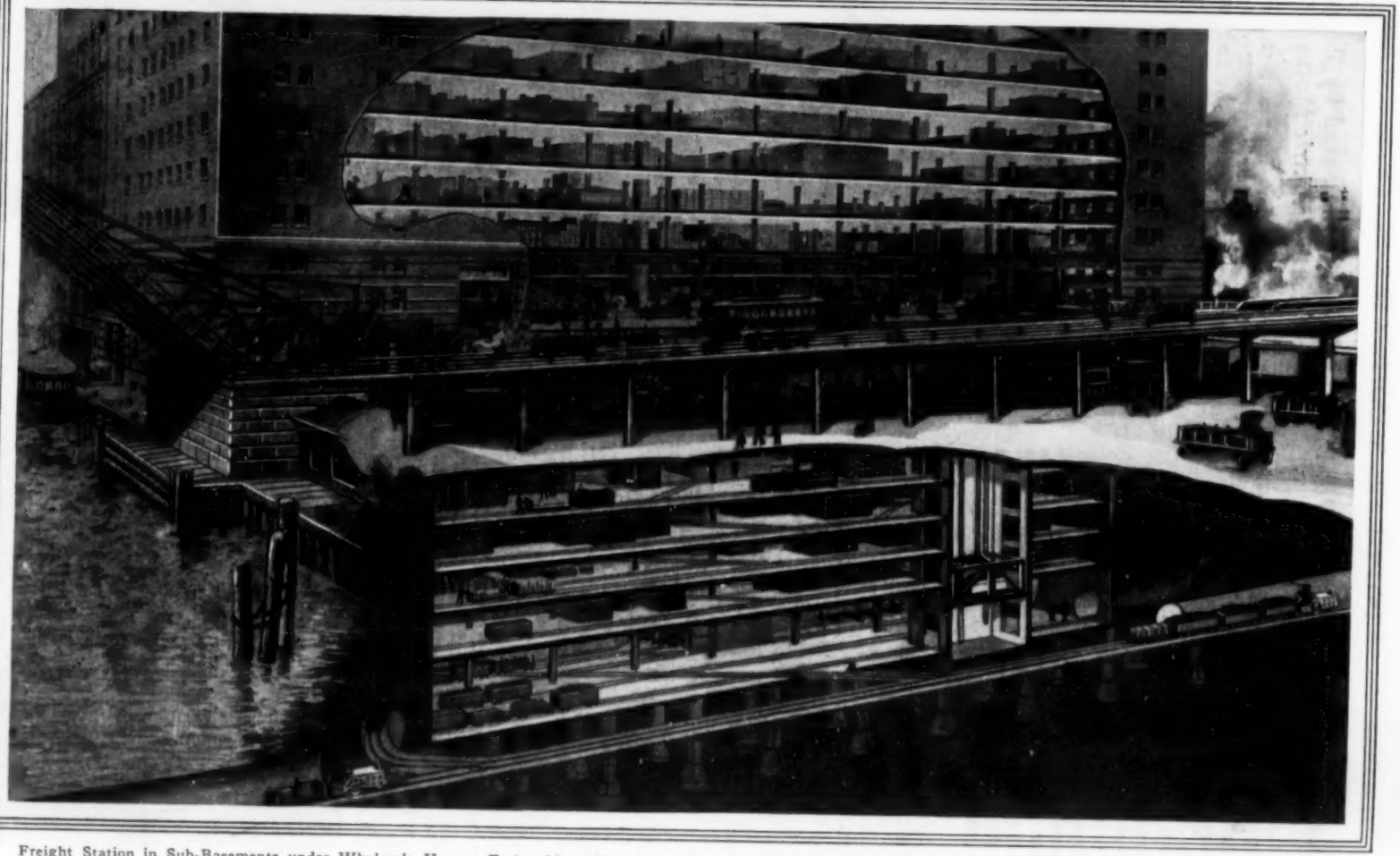
For removing carbon from automobile cylinders and valves, a brush operated by electricity has been placed on the market.

Removing Carbon Deposits from Cylinder Head with Stiff Wire Brush Operated by Electricity

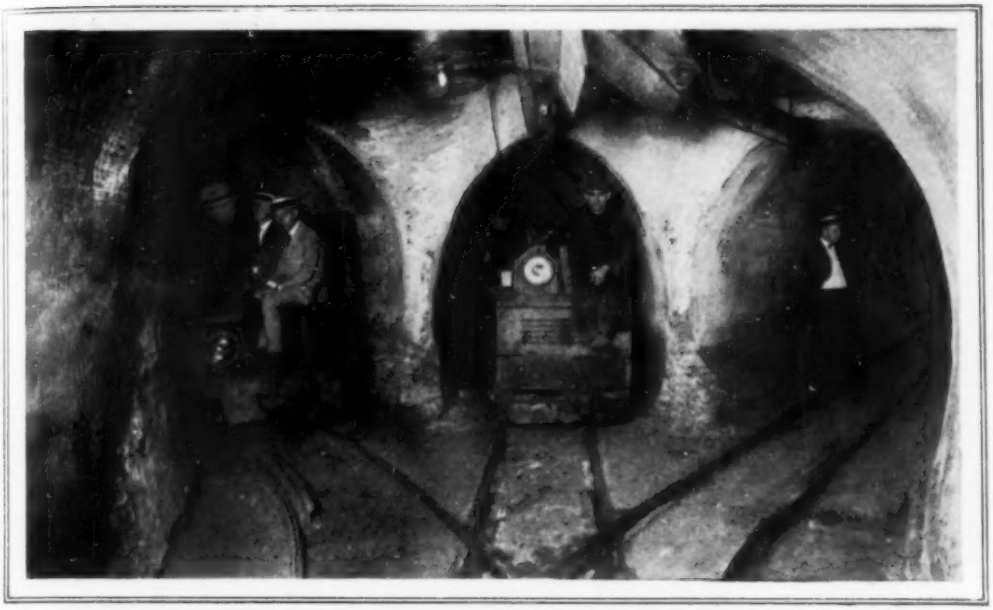
Made of stiff, heavy wire, the bristles overlap each other, resulting in a double contact so that the brush can be handled either tilted or in a vertical position to aid in cleaning the corners. Finer wires on another model similarly operated, give a high polish to machine surfaces and aluminum pistons.

Steelless World Is Predicted

Corrosion and increasing costs spell the doom of great steel-bridge constructions for the future, in the opinion of Gustav Lindenthal, the well-known consulting engineer, who predicts that within a span of time shorter than that from King Tutankhamen's day to this, the great metal viaducts of our age will have disappeared through rust and neglect and that iron ships and railroads will be curiosities. The zenith of large bridge building, it is said, will be reached within the next fifty or one hundred years because of the increased cost of iron and coal.



Freight Station in Sub-Basements under Wholesale House; Trains Made Up in Upper Basements Are Lowered by Elevator to Tunnel, on Fifth Underground Level



Rumbling Along, Fifty Feet beneath Congestion at One of the World's Busiest Surface Crossings, Swift Tunnel Trains Speed through Dim Passages

Lifting Lid from a City's Streets

Electric Trains in Sixty Miles of Tunnels Carry On Enormous Freight Traffic under Busiest Thoroughfares

FIFTY feet under the business district of Chicago there is in operation the world's most unique subway—sixty miles of electrified tunnels given over entirely to the transportation of freight. So silently and efficiently does it carry on its work of transporting hundreds of thousands of tons of freight every year that comparatively few persons know of its existence. In twenty-one years there has never been a collision in this subway, despite the fact that it is a single-track system. Only once in many years has the tunnel figured in the newspaper headlines, and that was when a gang of enterprising store burglars conceived the idea of using it as a means of escape and were caught.

It started in 1901, without any fanfare of trumpets. In 1903 the original company ran out of money, after building twenty miles of tunnels, and sold out to a new company. By 1909 the project was practically complete, with sixty miles of subway underlying practically every street in the downtown district. Today 145 electric locomotives and more than 3,000 miniature cars carry more than a million tons of freight each year through the tunnels. Approximately a hundred shafts connect with the sub-basements of downtown stores, office buildings and hotels, with the city hall and post office and all railroad stations but one, as well as four public freight-receiving stations.

From the railroad stations incoming freight is delivered direct to the basements of department stores and outgoing packages taken back to the depots. There is a constant movement of freight from one station to another and to both stores and railroads. At two coal depots, railroad cars dump their contents into hoppers to feed down to the tunnel cars. Thousands of tons of coal are thus delivered direct to the boiler rooms of stores and hotels. The ashes, in turn, are hauled away through the tunnel, lifted in car-load lots to the surface on the lake front and dumped to fill in new land. Five thousand trucks and teams are kept out of the congested downtown district every day because their contents are transported by tunnel. How much time is saved for shippers, it is impossible to estimate. As the railroads pay the cost of tunnel transportation to their freight stations, the

Carving a New Tunnel into the Clay with a Scraping Knife Is Strenuous Work but Overcoats Are Not Uncomfortable

shipper can send his truck to the nearest tunnel shaft, and thus save the delay that would be encountered if the truck had to pass through the busy downtown area.

One of the public receiving stations for freight is located in the fifth sub-basement beneath a large wholesale grocery house. The tunnel company occupies the third, fourth and fifth basement levels, the lower one being the tunnel level. Two immense electric elevators raise and lower the tunnel freight cars, four feet wide and twelve feet long.

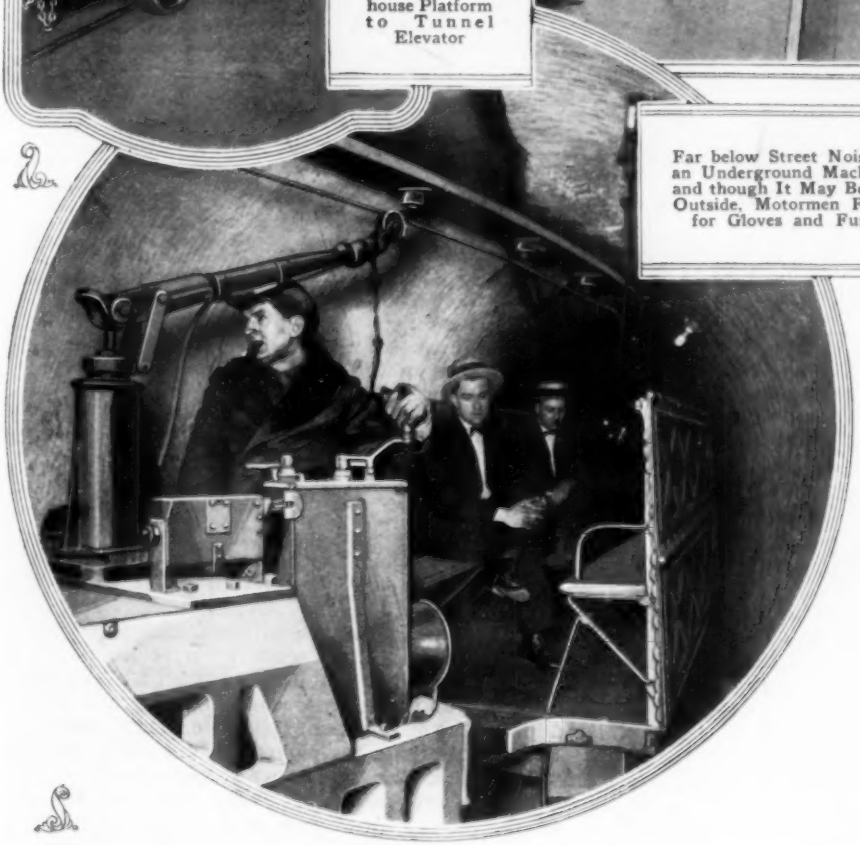
From the upper floors the grocery company receives and dispatches its own freight. On the ground level railroad tracks and a truck platform take care of freight cars, motor trucks and teams. Alongside the building is a dock where lake steamers and lighters of the merchants' transport service can discharge and load cargoes.

The third and fourth sub-basements are a maze of tracks, the two-foot gauge of the tunnel below. Here freight is classified and the cars loaded. Each of the one hundred stores, railroads and other customers has a number and, when the trains are made up, the motorman of the electric locomotive, who constitutes the entire train crew, is able to drop his cars off at the proper shafts. Because of the one-way traffic rule, adopted to avoid accidents, trains move in one direction under every other street, and in the opposite under the intervening thoroughfares. Electric block signals protect from head and rear-end collisions, and to guard against accidents at the 652 crossing intersections red and green mirror reflectors, similar to those used on dangerous highways, reflect the headlights of unseen trains in the intersecting tunnels. One of the unusual services of the freight subway is the disposal of earth excavated from new building sites. Instead of hauling the dirt away through the streets, a two-foot shaft is sunk until it intersects the tunnel, a train of cars backed into place and the material dropped down the chute, to be hauled away, lifted to the surface on the lake front and there used to fill in new land.

The construction of the tunnel itself was a triumph of engineering skill. Fifty feet under the city is a stratum of soft blue clay, of about the consistency of putty. Because of its softness, blasting was not effective, nor could picks and shovels dig it out. The tunnel engineers solved the problem by creating steel knives, with blades eight inches across and heavy handles on either side. With two miners wielding the knife the clay was literally shaved away from the tunnel heading.

To guard against an inrush of water in case of fire in one of the buildings served, automatic, water-tight fire doors are located at the foot of each shaft. Firemen may flood the building and fill the shaft, but little of the water can escape into the tunnel. In the hottest summer the crews, on arriving for work, change to woolen underwear and put on heavy overcoats with fur collars, add thick caps and mittens, and then are ready for work.

Left, "Mule" Pushing Load from Warehouse Platform to Tunnel Elevator



Far below Street Noises Hums an Underground Machine Shop and though It May Be Summer Outside, Motormen Find Need for Gloves and Fur Coats

Havoc Lurking in Grains of Dust Shown by Man-Made Blasts

It is estimated that there are about 21,000 factories and business establishments in the United States at present, subject to hazards from dust explosions. Most of them teach their workmen that dust in the air when exposed to a naked spark or flame is fully as dangerous as gasoline. But there are numerous records of destructive explosions, resulting from the accumulation of combustible dusts. provision of all lights with dustproof guards and the avoidance of accidental sparks are some of the steps being developed, while generation of static electricity in whirling machinery and speeding belts comes in for its share of attention from those striving to cut down fire losses. As part of a campaign of safety, experts have visited a number of plants where the dangerous dusts were present, taking with them one of the small models of grain elevators. When the workmen were gathered about the apparatus, the demonstrators collected some of the dust from the floors and produced strong explosions in the miniature building. In this way,

Shooting a Charge of Combustible Dust into a Miniature Model of a Grain Elevator, Where It Explodes When It Meets the Flame of a Burning Candle

powdered milk, grain, aluminum, rubber, cork, bark, cocoa, spice, fertilizer, and even soap. Researches by government experts show that where so-called "spontaneous combustion" has been held responsible for many fires, the real cause, especially of mysterious explosions, was dust. Seeking the remedies for such accidents, investigators have constructed miniature industrial buildings like grain elevators, and have duplicated factory conditions and produced explosions similar to those that actually occur. In these experiments, a lighted candle is set inside one of the tiny structures. With a bellows a small "charge" of dust is blown into the building and the explosion follows. To prevent the force from wrecking the structure, a paper section is set into the side or top. This is ripped off by the blast. In addition to these tests, plans for precautionary measures are being worked out. Methods of preventing those toiling in such plants were clearly shown the dangers of carelessness.

Flying and Building of Toy Planes to Speed French Air Progress

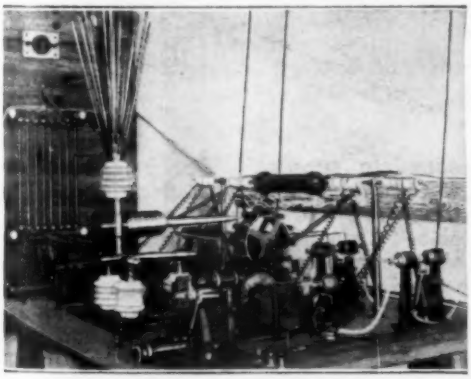
The flying and building of toy airplanes has been taken up by aviation enthusiasts in France, where contests are held under the supervision of the air ministry. The small machines are planned and constructed by the owners, who are encouraged in their work by a series of prizes offered by the government. Although numerous miniatures of aircraft are on the market, most of the "fans" prefer to originate their own models. It is believed that the wide-spread popularity of airplane modeling will soon cause many large cities to set aside flying fields where contests and try-outs can be held for the youthful builders of toy aircraft.

Blood Donors Establish New Trade in Supplying Hospitals

Since transfusion is now used in the treatment of about thirty ailments, professional blood donors have built up a profitable trade with hospitals. It is said that the operation is practically painless and causes no discomfort; besides, the "giver" receives a good price for his part in the affair. It has been discovered that even among men and women of the same race and family the quality of blood differs. For this reason, tests of the blood must be made to determine the particular kind required to combine properly with that of the patient. Many large hospitals have lists of fifty or more men upon whom they can call for an amount of blood. These are available any hour of the day or night. Among them are a number of college men who are working their way through school and take this method of adding to their finances.

Electricity Is Drawn from the Air and Made to Light Lamp

In an effort to collect electricity from the atmosphere, a French inventor has designed queer-looking apparatus that consists of batteries, a regulating device, and aerials branched in such a way that one points toward the zenith and the other toward the south. To stimulate the flow from the air, positive and negative charges



Insulated Aerials, Transformers and Batteries of Apparatus to Gather Electricity from the Air

first are sent through the antenna. These are stopped when the current is sufficiently strong to light a lamp.

Bean beetles, a Mexican pest, are said to be spreading northward at the rate of 150 miles a year.

Embroidering Head of the Savior Takes Woman Two Years

Stories from the Bible and episodes in the life of Christ have been depicted in embroidery by a Russian woman, a sample

Silk-Embroidered Christ-Head Banner on Which Russian Woman Worked Two Years

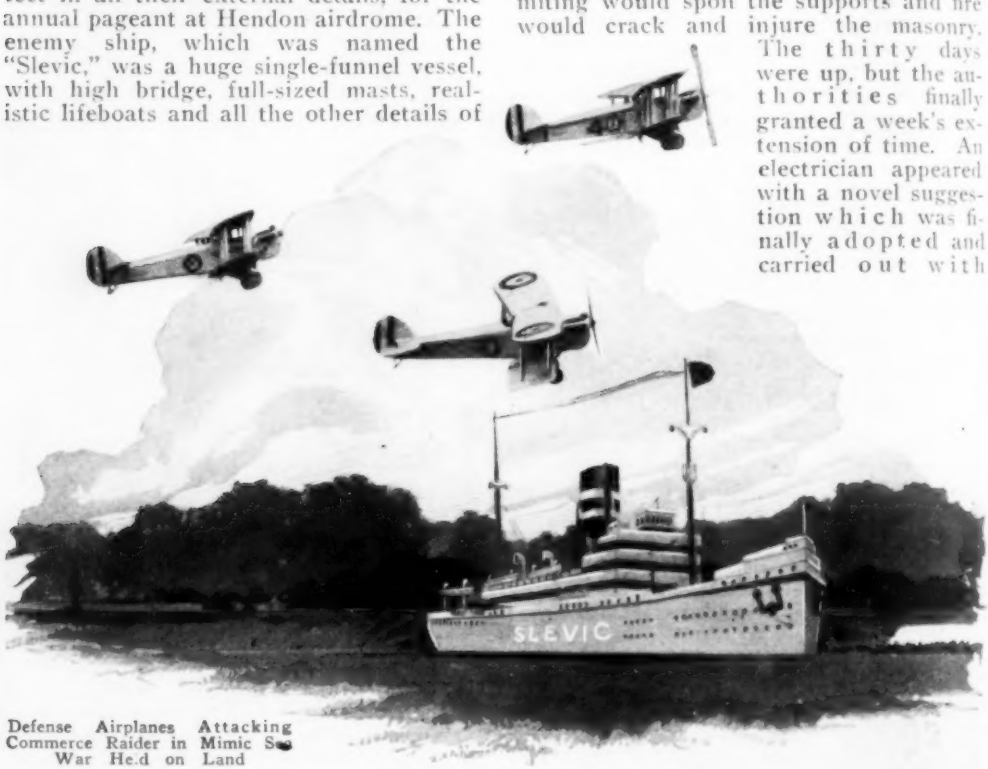
of whose work, "The Savior," was shown in the church of St. John the Evangelist in Boston, Mass. Two years were spent in completing the piece. Beginning in primitive times, this branch of the textile arts was known to the Romans as "paintings with the needle" and was widely employed in the Middle Ages and later times for religious purposes.

Ants Work for Lumbermen

While ants are generally considered a nuisance and often are destructive pests, natives of Burma have found a way to make the insects help them in preparing sandal wood for exportation. Only the hard, fragrant heart of the tree has any commercial value. After it is cut down, it is stripped of its branches and allowed to lie where the ants can reach the soft, outer covering of sappy wood. In a short time, the billions of tiny creatures have carried off the useless outer layers, leaving the center, which they do not molest because of its hardness, ready for the woodsmen.

Land-Sailing Ships Are Destroyed by Air Raiders' Bombs

As fine a tramp steamer as ever sailed a peaceful meadow was saved recently when British royal air force fliers bombed and destroyed an "enemy" commerce raider caught sailing down a field beside a railroad embankment. The two dry-land ships were constructed, life-size and perfect in all their external details, for the annual pageant at Hendon airdrome. The enemy ship, which was named the "Slevic," was a huge single-funnel vessel, with high bridge, full-sized masts, realistic lifeboats and all the other details of a ship in active service. The merchant ship was the conventional type of British tramp freighter, with a single funnel, well decks fore and aft, and cargo booms swung from the masts. The naval aircraft opened the attack with aerial torpedoes, which tore great holes in the sides and decks of the "Slevic." Bombs which fell alongside sent towering columns of earth squirting high above the masthead, giving a realistic imitation of the water column thrown up by a similar burst alongside a ship at sea.



Defense Airplanes Attacking Commerce Raider in Mimic Sea War Held on Land

Bridge Burned Apart by Electricity without Damaging Piers

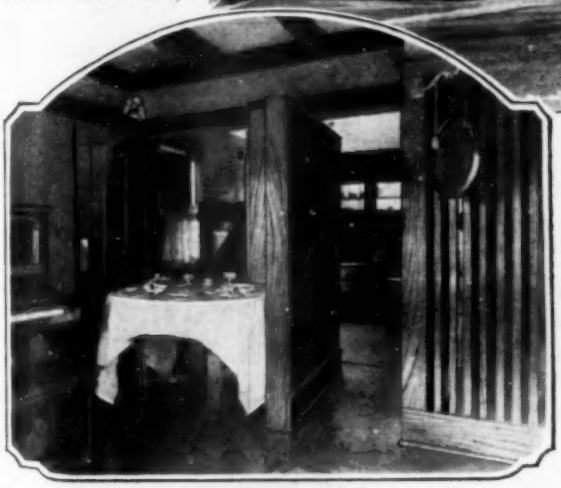
How electricity plus Yankee ingenuity helped a man fulfill a contract has been told recently, adding to the long list of novel feats that humanity's wonder-working ally has been called upon to perform. The owner of a wooden toll-bridge had agreed with county authorities to remove it in thirty days so that steel spans could be built on the old piers and abutments. How to wreck the bridge in the short time allowed without spoiling the foundations proved a problem. Professional wreckers were visited but all agreed that dynamiting would spoil the supports and fire would crack and injure the masonry.

The thirty days were up, but the authorities finally granted a week's extension of time. An electrician appeared with a novel suggestion which was finally adopted and carried out with complete success. The bridge timbers were burned apart with electricity. Fifty-four iron loops were constructed and placed about the sills of each span. They were connected with wires and current turned on. In a short time, the loops, acting as resistance coils, became red-hot and seared their way into the wood, cutting as an acetylene torch eats its way through metal. In an hour and forty minutes from the time the current was turned on, the mass of timbers crashed into the water beside the piers without the slightest injury to the latter and leaving a sharp, clean cut, charred only for a short distance. By 2 o'clock in the afternoon, nine hours after the burning was started, the last span fell amid the shouts of spectators who had gathered to watch the novel feat.

Folding Bungalow Saves Space in Home

House with Movable Walls and Cupboards That Shift at Touch of Buttons Saves Labor and Lowers Cost

WITH revolving walls, sliding china cabinets and tables that disappear as if by magic after meals are served, a folding bungalow residence erected in Chicago contains six rooms practically all of which can be converted for any of several purposes in a few moments. Motion of the partitions and furniture is controlled with push buttons or levers and all parts are so balanced in their positions that very little effort is required to swing a portion of the kitchen into the dining room or to whisk a heavily laden table from one side of a wall to the other. The house is twenty-six feet square and stands in the center of a spacious tree-shaded lot. Divided into living room, kitchen, downstairs bedroom, bath, and furnace compartment, on the lower floor, it has an upper room which opens onto two cozy sleeping porches.



Top, Interior of Folding Bungalow; Center, House and Grounds, and Below, Table Set Swinging into Dining Room

Attractive verandas surround the structure on two sides, one of which is arranged for use as a living porch. On the inside, near the entrance, a stairway runs to the second story, the lower part of the balustrade continuing into a set of bookshelves resting on the ground floor. No dining room is apparent, having been left out of the plan, but when meal time arrives, the wall between the living room and kitchen is caused to swing around, bringing into view a table prepared with all proper accessories of the repast. This convenience permits the table to be laid with cloth and china in the kitchen eliminating continual walking back and forth by the housewife. On the side of the wall above the table, a china cabinet has been set with one or two small shelves beneath, on which any extra articles may be put until needed. When the wall has turned completely into the new position, the table is released by a lever and

slides noiselessly into the center of the room. As the meal progresses, used dishes can be removed to the shelves of the china cabinet and when finally the table is no longer wanted, it is caused to resume its position against the wall and the whole structure rotated into the kitchen to its original place. The sink being built near the partition, the table can be quickly cleared and the dishes rinsed and replaced in the cabinet.

It is estimated that this one arrangement alone saves a total of half a mile of walking back and forth per day by the housekeeper. Fueling of the furnace is also reduced to very little labor, the heater being inclosed in a neat grating compartment which allows the escape of warmth into all parts of the home. The coal is held in a two-foot space behind the furnace and when delivered can be transferred from a truck outside through a window and piled up on a sloping surface that causes it to fall to the door of a chute near the furnace opening, necessitating but a half turn on the part of the attendant when shoveling the material into the fire.

The rear room of the house is equipped with a revolving dustpan so fixed that the dirt gathered up need only be put in it and a button pressed to deliver the rubbish to a container. Stationary laundry tubs in the kitchen lend their top as a drip board for the sink, while the provision cabinet is set with drawers and swinging doors in the lower section. Built into the back wall, this cabinet is prevented from impeding the entrance of light by having its back made of glass doors, which can be opened to allow any contents to be cooled without admitting cold air to the interior of the room.

Water and gas meters and the medicine chest for the bathroom are all combined into a small section of one of the walls and are out of the way except at such time as they need be reached. Swinging doors are inserted into the walls where convenient, and all of them can be easily fastened back when sections of the partitions are to be moved.

Manikins of Thin Wood Replace Wax Dummies in Paris Shops

For showing materials and garments in shop windows and display rooms, Paris merchants are posing manikins cut from thin slabs of wood instead of the expensive wax affairs. The models are painted in lifelike colors after they are carved, the fashion design being faithfully reproduced by skilled artists to show its effect when worn. In some cases the fabrics from which the clothing is made are draped over the forms.

Studio Where Manikins and Ornamental Display Material Are Cut from Thin Wood to Replace Wax and Clay Models Used in Shop Windows and Show-Room Exhibitions

Blindfolded with Pi'lowcases, Platoon of Officer Candidates at Plattsburg Practices Night-Fighting Tactics by Day under the Watchful and Critical Eyes of Commanders and Comrades

Night Warfare Taught during Day by Blindfolding Soldiers

Blindfolded by pillowcases, student soldiers at the Plattsburg training camp, by day learn some of the fine points of fighting at night. The hoods are so adjusted that practically all light is excluded, and to the soldier the effect is approximately the same as though he were in actual darkness or were passing through dense woods. Without seeing their instructors or each other, the rookies learn to group themselves in various positions, maintain their formations, prepare and execute charges and go through other maneuvers. Their actions can be more accurately studied by the officers than in real night practice, and the identity of any recruit that fails to execute the orders properly is readily ascertained.

Rovings of Freight Cars Are Shown by Records of Railways

Keeping track every day of the approximate 2,500,000 freight cars in the United States is one of the most intricate problems of modern railroading, but so well is the task performed, that a lost box car is practically unknown on American lines. Although it is the greatest rover of the rails, the whereabouts of a freight car is known at almost every hour of its twelve or fifteen years of actual service through an accurate checking system in the car-accounting departments of the individual lines. These offices not only keep track of the cars, but enable the roads to tell how much is due them from other lines and how much they owe other companies for the use of cars, a fixed charge of a dollar a day per car being the rate. When the train reaches a foreign line, the car accountant supplies the home road with the date of arrival. Thus at any time, officials can tell exactly where the cars are.

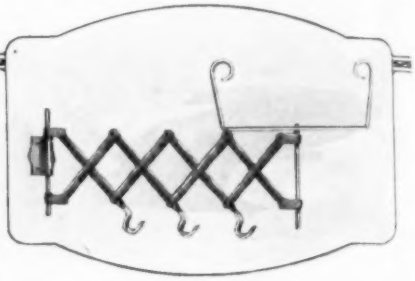
Strange Bird Has Growl of a Dog, Sleeps Days and Can't Fly

One of the strangest birds known to man, a "kiwi," survivor of a family that flourished more than a million years ago, has been obtained by the government from New Zealand in exchange for a cage of rare owls. About the size of a large domestic fowl, it has no wings and sleeps or remains inactive during the day. At night, it drives its long bill into the soil in search of worms to which it apparently is directed by the sense of smell. It can run swiftly and sometimes makes use of its sharp claws as weapons of defense by raising the foot to the breast and striking downward with considerable force. When the kiwi sleeps, it supports part of its weight by its bill which is rested on the ground. If disturbed, the bird yawns in a grotesque manner and makes sounds resembling the growls of a dog.

Drowsy "Kiwi" in Typical Daytime Position Which It Holds for Hours without Moving

Time and Money-Saving Tools

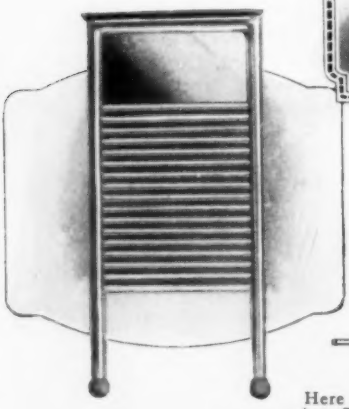
Creaming Corn Is Easy with Safety Knife That Shaves Kernels from Cob



There Is Room for Two Hats and Three Garments on This Collapsib'e Steel Hanger, Designed Especially for Limited Spaces; Clothing Cannot Touch the Walls, the Bracket Swings About and Is Easily Attached

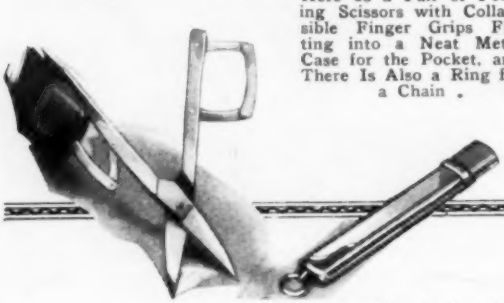
In Baking Pot at Left Housewives Have a Practical and Fuel-Saving Oven for Top of Electric, Oil or Gas Stove

Sanitary Glass Bracket Holder Keeps the Shaving Brush Handy



No Germs or Dirt Can Collect in All-Metal Washboard and It Lasts a Lifetime

Here Is a Pair of Folding Scissors with Collapsible Finger Grips Fitting into a Neat Metal Case for the Pocket, and There Is Also a Ring for a Chain



Catch Basin Fitted to Drain Pipe Keeps Refuse from Clogging the Sink

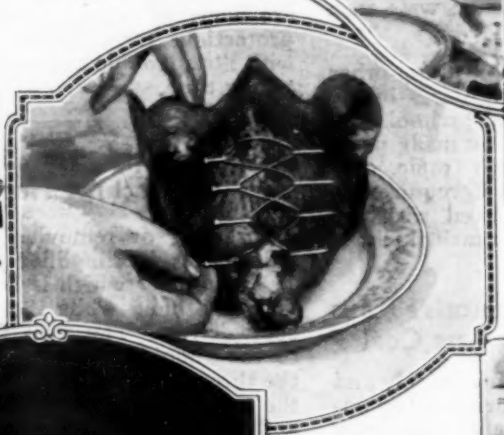
Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

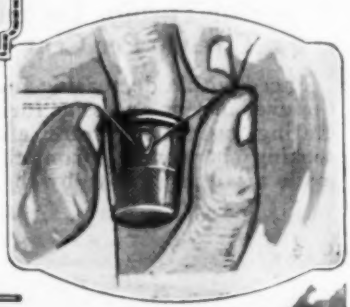
Although Only Three Inches Long and One Inch Wide in Its Leather Case, This Efficient Pocket Clothes Brush Spreads Out When Removed and Just Suits Travelers

Mud Is Quickly Removed from Soles and Heels with This Portable Scraper That Can Be Used Anywhere

Waffles and Pancakes Both Are Cooked at Table on This Combination Iron



Aluminum Pins and a String Save Trouble of Sewing Fowl



Teeth and Trouble Are Spared in Sewing by Handy Thread Cutter on Thimble

Days of the Makeshift Kitchen Table Are Over; Here Is a Compact and Serviceable Unit Equipped with Center Pail for Refuse, Adjustable Seat That Swings Out of the Way, Spacious Drawers and Cutting Boards, and a Sanitary Composition Top

Burns Are Avoided with Pronged Handle for Lifting Hot Plates

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

"Soft-Pedal" Paving of Rubber to Make Streets Noiseless

To deaden traffic noises, paving blocks of rubber have been tested in Boston to show their wearing qualities. It is claimed

Inspecting Rubber Paving "Stones," with Which Much of Traffic Noise May Be Silenced

this material will outlast almost any other kinds now in use. Thoroughfares in the vicinity of churches, hospitals, schools and courtrooms, it is said, can be made practically silent in spite of heavy traffic. Being flexible, such surfaces will require less repairs and replacing if paved with the rubber blocks, which are an inch thick.

Powerful Turbine Locomotive Runs on Twenty Per Cent Less Coal

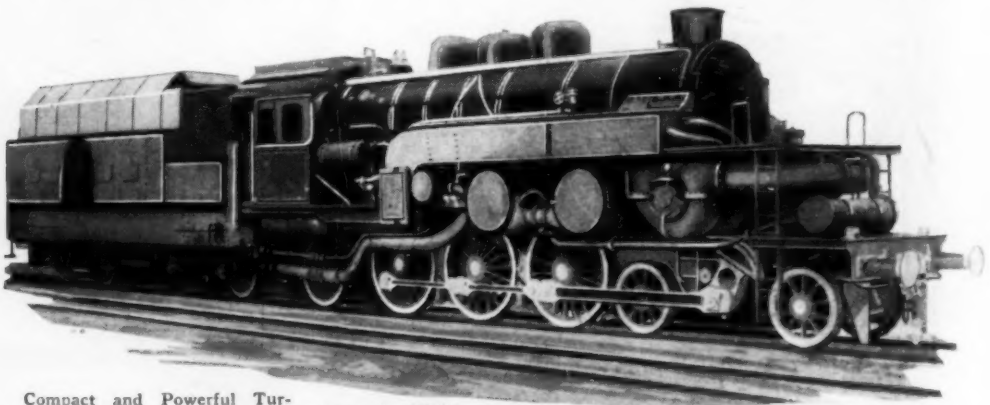
Faced with a decreasing fuel supply and the ever urgent necessity for reducing operating costs, engineers are constantly seeking improved locomotives, a need made more imperative by the competition offered by the gasoline-motor cars. The Krupp factories, famed for their war-time products, have built a compact and efficient turbine type of engine which is said to mark a distinct advance in locomotive design. It develops 2,000 horsepower, is capable of great speed and is said to effect a coal saving of twenty per cent over the usual type.

Lock Cistern Lid Prevents Accidents and Insures Clean Water Supply

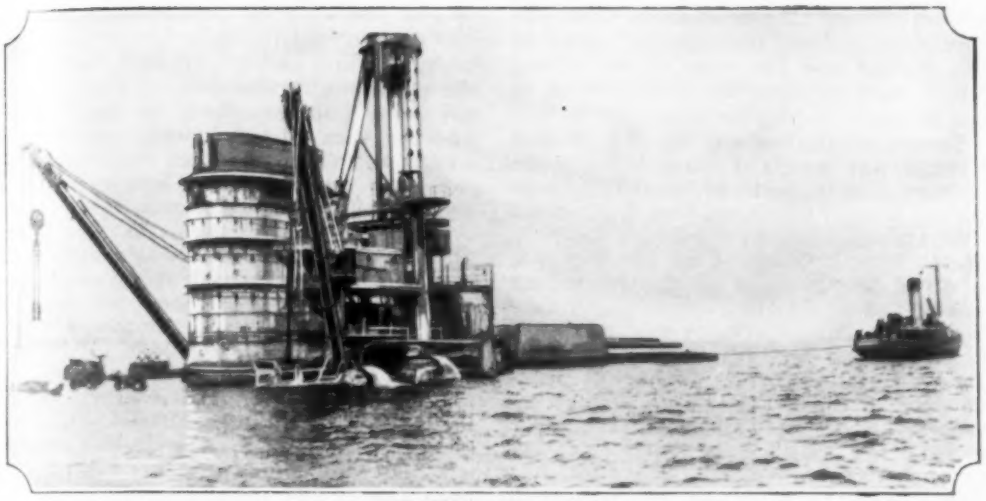
Cistern lids that can be fastened securely by means of a padlock passed through a strong iron clasp have been designed to prevent accidents and contamination of the water. They allow a twenty-inch opening, have an over-all measurement of twenty-seven inches and can be employed for covering cesspools, coal holes and other apertures where accidents are likely to occur. They are of special protection to children, can be fitted with little trouble and are designed to last a long time.

Screw Holder Saves Time and Labor in Reaching Hard Places

Inserting or removing screws in difficult places is simplified by means of a slender holder which is held conveniently with one hand while the other turns the screwdriver. The grip fastens securely to the shoulder of the screw just above the threads so that it cannot drop out and the tool can be adjusted to various lengths and angles. It is especially adapted to piano work, building and repairing radio sets and to all sorts of electrical jobs.



Compact and Powerful Turbine Locomotive Built in German Factories Which Is Said to Effect a Fuel Saving of Twenty Per Cent



Salvaging the Former German Battleship "Hindenburg" from the Muddy Bottom of Scapa Flow, Where It Was Sunk with More Than a Half Hundred Similar Craft Over Five Years Ago

Raising Wrecks from the Sea Bed

Romance and Science of Modern Diver Salving Germany's Drowned Fleet at Scapa Flow

TWENTY-FIVE fathoms deep beneath the icy, green waters of a northern sea, land-locked in part and flanked by towering cliffs, lie the rotting hulls of sixty-eight German battleships whose sea cocks were opened on June 21, 1919. Mountains of silt cover their armor plate, and their turrets and decks, fore, aft and amidships, bristle with barnacles and other forms of marine life and vegetation.

At the moment a big firm of British salvors is engaged on the gigantic task of raising these submerged vessels, for the purpose of securing the costly metals—copper, bronze, brass, nickel, iron and selenium, the latter an exceedingly rare metal used in the construction of their wireless and other electrical apparatus. It is thought possible, too, that somewhere in the admiral's flagship, hidden in water-tight receptacles, may be valuable secret documents of importance. The salvage work at Scapa Flow started in April, 1924.

Most of these submerged vessels lie at a depth which is well within that at which useful diving operations can be undertaken. The greatest depth so far attained by the British admiralty is thirty-five fathoms. The great German battleships "Seidlitz," "Hindenburg" and the rest of the high-sea fleet lie in some twenty-two fathoms of water, and the limit of time for which the diver may remain under water is about thirty minutes. He has to breathe compressed air forced down to him by powerful air pumps, since otherwise his lungs would instantly stop working and blood flow from his nose and mouth. To enable him to stand firmly on the bottom and resist the very powerful thrust and pressure of the water, he carries forty pounds of lead on his chest, the same on his back, sixteen pounds on each boot and altogether wears an equipment of 175 pounds' weight.

The diver's sensation on first entering the water is an uncomfortable one. The sea seems to be gripping him all round. His breath comes with a gasp as his helmet submerges and there is a pressure of water at his chest and abdomen greater than that at the valve outlet of his helmet. One of the first things he has to do is to adjust the spring of the outlet valve and so regulate the pressure that he may quickly shoot down to the sea bed, clutching the "shot rope." There he finds he can breathe more easily by crawling on the slime than standing and walking upright.

Submarine accidents to divers are really strangely few, considering the conditions under which they work. Their most dangerous foe is the grisly octopus which is apt to fasten its tentacles to an arm or a leg, and then a violent struggle follows on the bottom of the sea. Making super-

human efforts to free himself from the creature's suckers, the diver is hauled to the surface and the crew of the diving vessel hack with an ax at the limbs of the furiously lashing devilfish.

Divers at the salving of the sunken German war vessels at Scapa Flow, in the Orkney islands, north of Scotland, where lay the base of the grand fleet in the great war, are not likely to encounter devilfish, sharks or other terrors of the deep sea, nor will they wander amidst entrancing scenes and marine landscapes where fantastic vegetation and many-colored organisms wave to and fro in ocean's green translucent tides. The sun's rays penetrate but a short distance below the surface of the water and all the divers will see will be the silted hulls looming darkly through the dim shades, twenty fathoms deep. When they blast their way through the barnacled plates, they will find no heaped-up doubloons as in the treasure room of a Spanish galleon of the sixteenth century, nor any gold bars such as it took three years to raise from the storeroom of the liner "Laurentic," torpedoed off the northwest Irish coast in 1918.

Mechanical "grabs" worked by electricity from the salvage vessel, shift the wreckage, and by means of the modern oxyhydrogen torch, steel plate can be melted under water. This is done by the aid of a strong jet of compressed air which forces back the water. The great hulls of the battleships will be raised by stopping every hole except two cavities into one of which compressed air is forced; out of the other is driven the salt water. As for the thirty German destroyers whose wrecks lie in the shallower water, they will be salved by the use of great pontoons on either side of their hulls. A wire hawser is slung under the keel and passed over drums on the pontoons, at low tide. As the water rises, the pontoons haul up the wreck and are then towed in until the wreck strikes bottom again, when the process is repeated; thus gradually with each tide, the destroyer is drawn nearer the surface.

Before this entire high-seas fleet of a once great marine power was sent to the bottom, interest of salvaging concerns and untiring treasure hunters, who hoped to find untold wealth in the long-hidden hulk of some ancient galleon, was centered in the old Spanish Main and in and about waters where noteworthy naval maneuvers were known to have taken place in the long ago. Hundreds of thousands of dollars of private wealth have been poured into such undertakings since the first diving suit was successfully demonstrated. Some of the quests proved profitable to their sponsors, while the most of them turned out to be in vain. Either charts supposed to contain exact information as to the whereabouts of the sunken hoards were false, or in cases where the submerged vessels were really located, the reported treasure was absent from the wreck. Almost annually attempts have been made by groups of individuals and legitimate salvaging firms to locate certain wrecks of craft sunken in storm or battle centuries ago and popularly reputed to have been loaded with gold, jewels or other treasure when they went down. These expeditions are generally well organized and financed. Expert divers are employed, crews of veteran seamen recruited, and the best-equipped ships chartered.

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Sea-Stained Superstructure of the "Hindenburg" Protruding from the Sea Which Failed to Engulf Entirely the Monster Vessel

Rugs Woven in the United States Rival Those of the Orient

Rivaling in workmanship and design the costly products of eastern looms, "oriental" rugs are being woven in a New York studio by two women who have mastered the intricate art. Their accomplishment has led to the suggestion that American women forsake other less enduring forms of handiwork for this difficult but fascinating craft and, by devoting to weaving time that they now put on fancy work and other more trivial pastimes, create beautiful and lasting heirlooms. A sample is hung on the studio wall—a little rug fourteen by twenty-two inches. Those who have seen it declare that it might easily be mistaken for a century-old creation of a Persian artist. Cotton threads were tied with wool strands into as many as a hundred knots to the square inch and finer wool was woven among them. Finally, the scraggly ends had to be clipped, a task more difficult than mowing a lawn evenly with a scythe. Weavers of the Orient, it is explained, are able to live on a few cents a day so that American domestic labor never can hope to compete with them.

Fastener Cuts Hole, Rivets Eyelet for Binding Papers

Originally intended for office use only, an eyelet fastener is now being used by bookbinders, printers, manufacturers and business institutions for binding, fastening and sealing. With its assistance, holes are punched in cloth, cardboard, leather and metal and the eyelets inserted and clinched.

Hand Type Is Set from Typewriter and Automatically Distributed

Setting hand type into forms with any standard-keyboard typewriter is accomplished by an ingenious apparatus which automatically returns used characters to their respective places in the type case at the same time. Machine and typewriter are electrically connected, and as the typist taps the keys, plungers beneath each of the type arms and the space bar complete electric circuits which cause corresponding characters in the machine to slide out of V-shaped cases into their proper positions. One of the setters, it is said, can keep from four to six presses busy on duplicating work. The type is distributed by an endless-chain arrangement without interfering with the setting, and as the typewriter is operated, it prepares copy for proofreading.

As Stenographer Taps Out Copy, Her Keyboard Sets Type Simultaneously in the V-Shaped Machine in Front of Her

Telephone lines are becoming busier every year, according to figures of the census bureau which show that in 1922, 24,738,000,000 calls originated in the United States, an increase of nearly 3,000,000,000 over 1917.

Weight of Egg Unlocks Door of Pen Automatically Separating Hens

Separating the hens that lay from unproductive ones is simplified by a nest now being manufactured for poultry raisers.

Poultry Separator Showing Exit for Non-Laying Hens, Entrance and Egg Drawer

It is a sanitary metal-box arrangement with an aperture through which the hen may enter from the yard in which all the fowls are kept. The door automatically closes behind her. If she lays, the weight of the egg falling upon a trap unlocks an exit into an adjoining pen. If she does not, the layer's exit remains locked and another door through which she returns to the general pen is unlocked. The weight of the hen, leaving by either door, opens the entrance for the next hen. This separator is designed to eliminate breakage in the nest and the egg-eating habit that frequently follows, to prevent the incubation of fertile eggs and to save the expense and labor of putting complicated traps in the nests. It is entirely automatic, is easily cleaned and cannot get out of order, it is claimed. By arranging a succession of these separators in different pens, in a few days the poultryman will have segregated his producing fowls.

Motor-Driven Turbine Fire Engine Is Light and Has Many Uses

Equipped with a centrifugal turbine pump, a fire engine has made its appearance in England that is said to weigh only one-third as much as the usual type and yet is of equal capacity and strength. It may be drawn either by hand or by a light motor car and is intended mainly as an auxiliary to large fire stations, or for country estates and villages remote from efficient fire departments as well as for factories. The pump delivers 200 gallons of water a minute at 135 pounds' pressure, and 400 gallons at sixty pounds. It can, of course, be used for many other purposes besides fighting fires, as for draining places during floods.

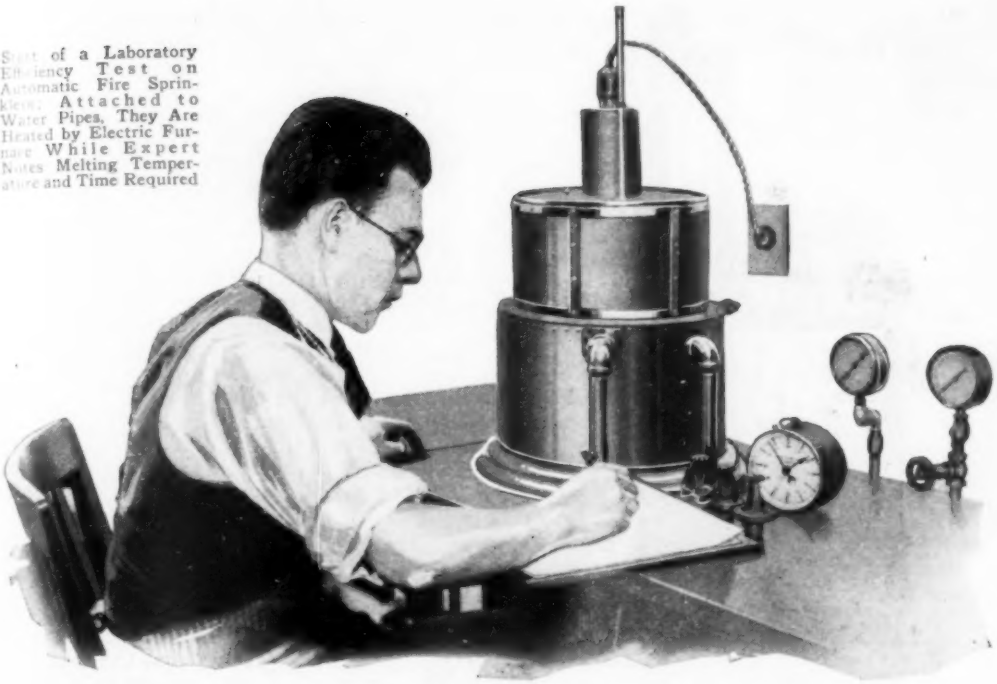
Folding Steel Horses Carry a Ton and Occupy Little Space

Folding steel horses have been placed on the market for the convenience of mechanics and owners of home workshops. As the legs fold up into the body, the device is convenient to store and to haul to and from the job. Although weighing only sixteen pounds, each horse will support more than a ton, and, being quite flexible, it readily adapts itself to uneven surfaces.

A series of "keyhole" perforations in the top permit the attaching of clamps for holding boards in place for gluing jobs. Its field of usefulness is even greater than that of the ordinary wooden horse, owing to its greater strength and compactness.

Condition of Fire Extinguisher Is Shown at Glance

To indicate at a glance whether a chemical fire extinguisher is ready for use, a small indicator has been made. The device includes a ball in a glass tube that disappears into an upper compartment when the extinguisher is tipped over and remains there until the tank has been recharged or repaired. Rough handling during fire drills or tampering may spill the sulphuric acid from the bottle into the soda solution, thus neutralizing the contents. A glance at the indicator by a passing observer will show at once whether this has happened.



Start of a Laboratory Efficiency Test on Automatic Fire Sprinklers Attached to Water Pipes. They Are Heated by Electric Furnace While Expert Notes Melting Temperature and Time Required

How Science Protects You from Danger

Huge Laboratories Devoted to Testing Inventors' Ideas in Flame-Proof, Thief-Proof and Danger-Proof Appliances

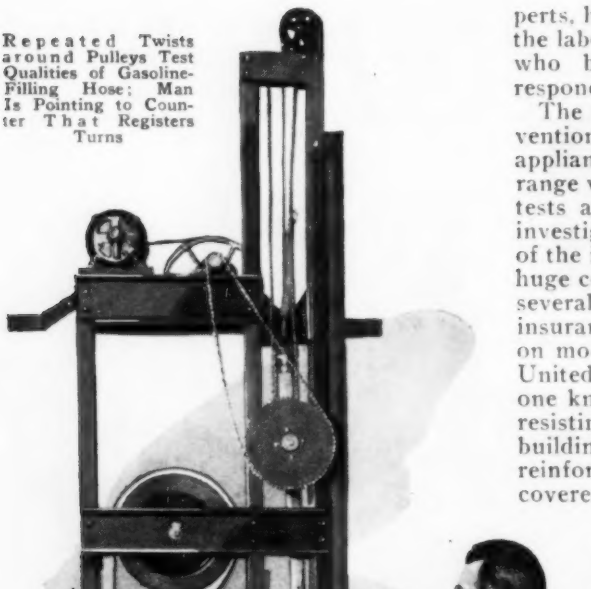
A HUGE furnace door, ten feet square, built of fire brick and steel, swings open on giant hinges, and out of the flaming pit workmen drag a hand car on which reposes a big office safe, cherry-red from an hour's subjection to a heat of 2,000 degrees. The car is trundled down the track and comes to a halt beneath a towering shaft which pierces the upper floors of the building. Out of the darkness overhead slips a block and tackle to snatch up a chain cradle placed beneath the glowing safe.

With its burden the block disappears back up its shaft, and the workmen drag the hand car aside. A lever is jerked back and the steel floor of the shaft, with the rails of the hand-car track, opens in two giant leaves, exposing an eleven-foot thick block of concrete. Thirty feet up the shaft the red-hot safe has halted.

"Time," a voice calls.

With a terrific crash the safe drops thirty feet to the solid concrete, battering its sides and breaking off the casters and feet. Just two minutes have elapsed since the gas was turned off in the furnace. The hoist jerks it into the air again, the leaves of the steel floor glide back into place, the hand car is trundled forward, and then back into the furnace with its burden, still red-hot. The furnace door closes, the gas is lighted, and another hour's "cooking" of the steel mass begins.

The day's work is well under way in the Underwriters' Laboratories, at Chicago. In an adjoining room there is another splintering crash. A 2,000-pound cylindrical weight, with wedge-shaped nose and mounted on ball-bearing wheels, has just dashed down an inclined track at terrific speed and crashed into a beautifully nickelplated automobile bumper, mounted on a chassis below. The bumper bends far inward, and then, as the good steel takes up the blow, it rebounds with a force that hurls the ton weight a half dozen feet back up the incline, where a ratchet catches and holds it. A stylus, though, has traveled over a paper mounted on the side of the engine and recorded the exact amount the bumper bent at the



Repeated Twists around Pulleys Test Qualities of Gasoline-Filling Hose; Man Is Pointing to Counter That Registers Turns

moment of greatest strain. The automobile-safety department is on the job measuring how much rebate on your insurance you should get if your car is equipped with that make of bumper.

Upstairs a little machine is methodically and automatically sticking keys into three automobile-transmission locks, turning them around, turning them back, withdrawing them and then repeating the operation, over and over, while an automatic counter records the number of times the operation is repeated before friction and wear breaks down the locks. The result will be passed on to you when the insurance agent figures the reduction in the premium on your car because you have an efficient burglar-proof lock.

The laboratories, a block of big three-story buildings, is a unique establishment, a topsy-turvy land where experts devote their lives to burning, breaking, smashing or otherwise wrecking the things that other experts have created. If the inventor's wits and skill can defeat, for a given time, the wits and skill of these experts, his device will be entitled to display the label of the underwriters, and the user who buys insurance will benefit correspondingly.

The work covers the range of fire-prevention, safety and burglar-prevention appliances. Anything coming within its range will be tested, and in addition to the tests arranged by manufacturers, special investigations are conducted at the request of the insurance companies themselves. A huge column-testing furnace was installed several years ago at the expense of the insurance companies guaranteeing risks on modern fireproof buildings and of the United States bureau of standards. No one knew at the time the fire and strain-resisting qualities of various kinds of building columns, including plain steel, reinforced concrete and steel pillars covered with concrete. For practically all of the work special machinery must be designed and built, and for this purpose a completely equipped machine shop is maintained. Some of the testing appliances are so small that they may be carried in the palm of one hand, and others so big special buildings were designed to house them. One of the smallest is a tiny trip hammer used to test matches. The underwriters' specifications require that a match must light only when struck on the head. Placed under the little hammer, the weight falls on the side of the head, and, if the match is safe, mashes the head to a pulp without lighting it.

Another little trip hammer tests the strength of the match stick, to insure that it comes from good stock which will not break, causing a lighted head to fly off through the air, to drop, possibly, among inflammable papers in your waste basket, or oil-soaked rags in the garage or shop. A good match stick should have no afterglow, and an expert sticks rows of matches in holes in a steel block, then lights them and watches the flames die out.

In the past fire investigators explained all unexplainable fires by attributing them to rats or mice gnawing matches. The laboratories decided to inquire into the matter. A supply of rats and mice was caught and placed in cages, strewn with inflammable straw. In each cage fifty matches were scattered. Not a single rat or mouse was found that did not prefer to starve to death rather than eat match heads; so another belief was exploded.

For many years the underwriters have

conducted exhaustive inspection tests of every length of fire hose manufactured, but recently the manufacturers asked for information about the wearing qualities of the hose from which automobile gasoline tanks are filled at service stations. A special machine was designed, and now, all day long, it automatically pulls a length of hose up and down, around two pulleys, to determine how soon the constant bending and rebending will break down the cotton covering. An automatic counter records the number of times the operation is repeated.

Another machine, almost human in the things it does, takes any kind of electric-light switch, whether turn-key, push-button, knife or toggle, and turns them on and off countless times to see how soon they will break down from wear. The machine requires no attention, for again the counter tells the story.

In the electrical department everything, from curling irons to baby incubators, is tested for freedom from fire danger and accident risks of other nature.

With the recent remarkable turning from coal to fuel oil for heating purposes in the family furnace, burners for the purpose came on the market so rapidly that the fire-insurance companies called for special data on their freedom from fire danger. A half dozen secondhand furnaces, obtained from a wrecking company, were set up and samples of all the oil burners called for. The samples came so fast that it was necessary to add another half dozen furnaces to the battery, so that twelve tests could be conducted simultaneously. For years a special department has been devoted to testing acetylene-lighting outfits designed for farm-home use. On one occasion an inventor, after being told that his outfit would blow up if subjected to the test, because of structural defects, asserted his confidence in his brain child by offering to stand beside it during the experiment. Unable to dissuade him, the engineers gave in, and after the explosion used a two-inch fire hose to wash the mess of carbide off the inventor. On another occasion the inventor of a "burglar-proof" automobile lock applied for a test. The chief feature of his lock was a siren, concealed in the car, which was supposed to start blowing if the lock was tampered with, and keep on blowing until the owner appeared to shut it off. While the inventor arranged for the experiment one of the experts of the lock-testing division slipped outside, picked the lock of the inventor's own car without starting his siren device, and moved the car behind the building. When the inventor appeared to claim his car and couldn't find it, he was informed that the test was over.

Since the work of the laboratory is to defeat the purpose of any invention, if it is humanly possible to do so, the engineers are experts at such tasks. They match their wits against inventors to pick flaws in their products. In the burglar-alarm department every effort is made to

Testing Auto-Transmission Locks in Device That Turns Keys Automatically

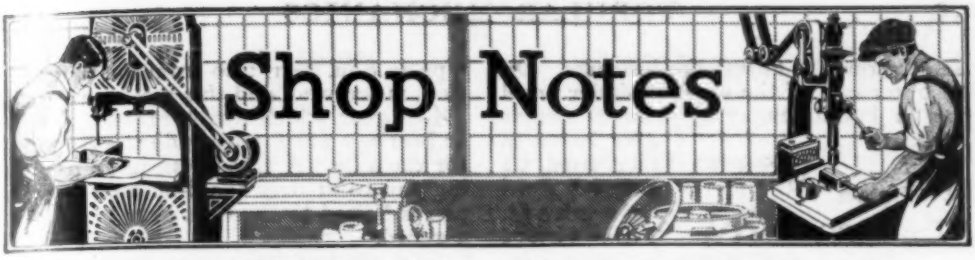
keep one jump ahead of the burglars by finding new ways to defeat the alarms, and then developing ways to prevent that defeat. The developments are passed on to the manufacturer, and the alarms changed to checkmate the burglar.

Fire-prevention devices utilize a large part of the laboratory equipment. Huge furnaces, twenty feet high, are equipped with fronts which slide on overhead tracks. A fire door or wire-glass fire window to be tested is built up in the door, with a brick frame around it, just as in actual use, and then locked in front of the furnace gas jets. Electrical thermometers and elaborate measuring devices record the progress of the test, and if the device withstands all of the heat tests, it is wheeled to one side and subjected to a stream of water from a fire hose to see if it will break down from too rapid cooling when the firemen arrive. One of the most interesting devices tested in recent years was a small glass disk, coated with pure gold, to prevent inflammable moving-picture film from catching fire, even though the film came to a complete stop. Ordinarily such film bursts into flame if the machine even slows down. The principle of the device is that the gold coating prevents the red heat rays from passing through to the film. In use, it will be released and drop into place before the light if the machine slows down to the danger point.

In the test it was found that a piece of dangerous film could be left for hours in front of the gold-coated screen without catching fire, but that it would burst into flame the instant the screen was removed. The same principle of repelling heat rays is used in the hangars for dirigible airships. The skylights are fitted with amber glass to keep the sun's heat rays from expanding the gas in the airship.

One enterprising inventor recently submitted for testing a wire-glass window which embodied the same principle. His glass had a yellow cast, and he believed it would keep the heat rays from passing through. The laboratory found it would do all the inventor claimed for it, but unfortunately the glass, while preventing the heat rays from passing, absorbed them itself, and therefore melted more quickly than ordinary glass.

Testing Safety-Match Sticks and Heads, and View in Busy Furnace Room Where Oil-Burning Attachments Are Put on Trial to Protect Makers, Merchants and Buyers

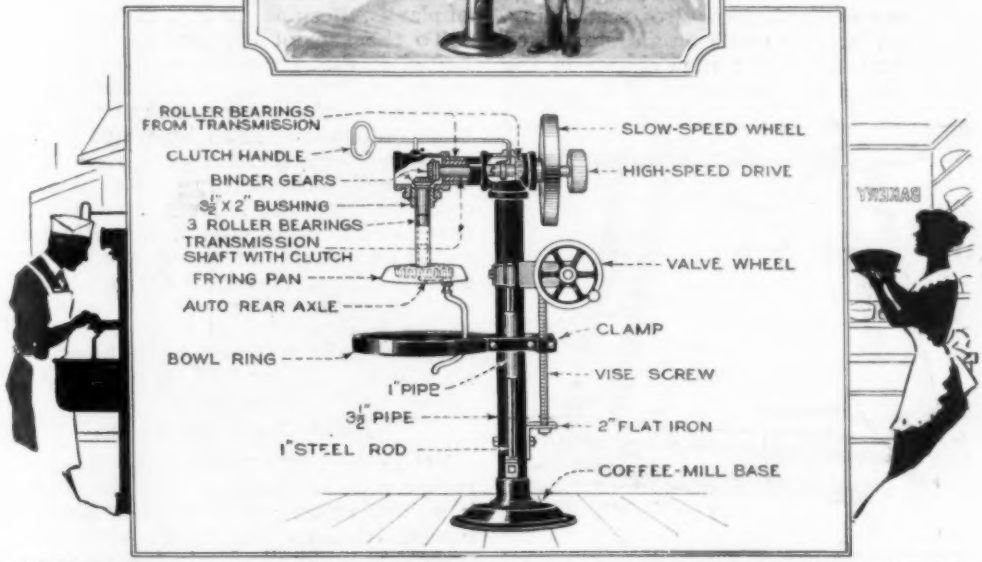


All Shop Notes published in 1923, in book form—Fifty Cents—from our Book Department

Mixing Machine for Small Bakery

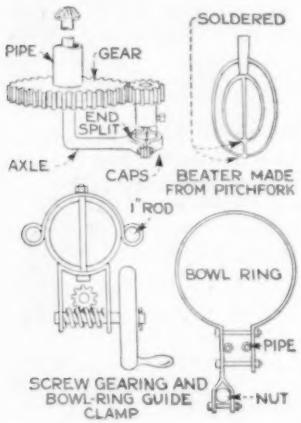
By GEO. W. VAUGHTERS

THE illustrations accompanying this article show a homemade cake and dough-mixing machine that cost me less than $10, counting the cost of all the new material used. This included two 3½-in. tees, 4½ ft. of 3½-in. pipe, 8 ft. ¼ by 2-in. flat iron, two lengths of 1-in. steel rod, and two pieces of 1-in. pipe, 8-in. long. The remainder of the material was taken from the junk pile. The base of the machine is an old coffee-mill base; into this is screwed the 3½-in. pipe upright, and on top of this a tee. A short length of pipe connects this tee with another one, as shown in the drawing. The horizontal shaft, that runs inside the tees, and the short pipe were taken from an old auto transmission, using the direct-drive gears as a clutch. A slot is cut in the top of the tee on the top of the column, to allow the end of the bent rod that acts as a clutch handle or shifter to enter and engage with a groove cut around one side of the clutch. This part of the clutch slides on a square shaft, to which an additional 8-in. length is welded, to allow the driving pulleys to be attached to it. The transmission case had round sleeves screwed into it to contain the shaft roller bearings, and these just fitted inside the pipe. By drilling and tapping the tees, I was able to



A Mixing Machine for the Small Bakery That Cost Less than $10, and Mixes Dough, Mashes Potatoes and the Like, Much Quicker than the Operations Can Be Done by Hand

use setscrews to adjust the bearings. On the outer end of the shaft a binder bevel gear is keyed, engaging with a similar gear keyed to the end of an old Ford axle shaft. This shaft was bent 4 in. from the opposite end, the bent end slit lengthwise, and the two ears thus formed bent back at right angles to the shaft. The ears were then drilled, and two old connecting-rod caps bolted in place as shown in the detail, to form a bearing for a 2½-in. gear or pinion taken from the transmission. This pinion has a long hub that runs in the bearing, and is drilled and tapped below the latter for a setscrew to hold the beater.



Into the outer tee a 3½ by 2-in. bushing is screwed, and a length of 2-in. pipe is screwed into this. On the end of the pipe an 8-in. gear, also from the transmission, is screwed, and this meshes with the 2½-in. gear, which travels around it. Roller bearings are fitted inside the 2-in. pipe for the axle. A hole is cut in an old frying pan to fit over the 2-in. pipe, and the pan is bolted to the 8-in. gear to serve as a guard.

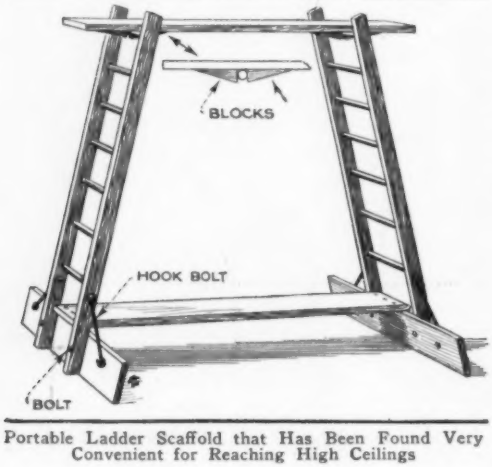
The gearing for raising and lowering the bowl is mostly scrap, with the exception of the bowl ring, which is made of the ¼ by 2-in. iron. This is fitted with two pieces of 1-in. pipe, which slide on the two 1-in. rods fastened to the column; the wheel is one taken from an old valve. The method of making and mounting the bowl ring and gearing is quite apparent from the drawing.

The beater rod shown in the large drawing is made of ⅝-in. round-steel rod, and is used for stiff dough. This can be removed and a beater made from a five-tine fork substituted for it; the latter is used for soft dough, batter, and for mashing potatoes. The drive is arranged so that when the belt is on the large pulley, the beater travels around the bowl 16 times a minute, and when on the smaller one 60 times a minute.

This machine will mash 1½ bu. of potatoes in a few minutes, and will mix 40 qt. of cake dough in a surprisingly short time.

Portable Ladder Scaffold

Cleaning and repairing skylights, hanging fixtures, painting and papering ceilings and other work that requires scaffolding, can often be done easily on an improvised ladder scaffold of the type shown in the illustration. It consists of two ladders, four planks, and a few bolts and bolt hooks, to hold the ladders and planks together securely, and can be set up much more quickly than a scaffold made entirely of planks. Besides this, it is easily portable.



Portable Ladder Scaffold that Has Been Found Very Convenient for Reaching High Ceilings

To the legs of each ladder a plank is bolted so that the edge rests on the floor as shown, holes being drilled through the legs and planks to receive the bolts. The hook bolts are used as braces to provide additional stability. A crosspiece is securely nailed to the top of the planks in order to keep the ladders from slipping apart, and another crosspiece, with cleats nailed on one side to receive the top rung of each ladder as shown in the detail, holds the tops of the ladders apart. The height of the ladders may, of course, vary and the length of the planks should be proportional.—G. A. Luers, Washington, D. C.

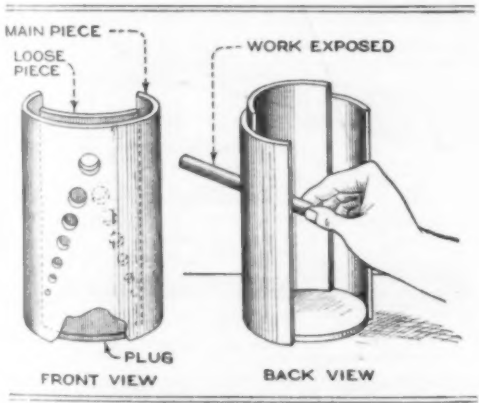
Lathe-Center Lubricant

White lead and sperm oil, mixed together with just enough graphite to give it a dark color, makes a good lubricant for lathe centers. This grease can be kept in a tin box and oil added when necessary, to keep it from becoming too thick.

Acetylene-Flame Shield

Much use is now being made of the acetylene torch for tool hardening and in this connection the shield shown in the illustration will be found handy. When heating up the ends of short, round pieces it is necessary to keep the work turning around so that the heat will be applied evenly. To do this by means of tongs held in the hand is a difficult matter, but with the aid of a shield to protect the hands from the heat, the work can easily be done. The shield is made from a short length of 6-in. iron pipe with the bottom end closed with a piece of sheet metal, and a piece of the side cut out, as shown in the back view. A number of holes of various diameters are drilled in a diagonal line through the side of the pipe, as shown, and the same thing done to the piece cut out, with the difference, however, that the holes in this piece slant in the opposite direction.

In use, the loose or sawed-out portion is placed inside of the main piece, as shown, resting on the plugged end. It will be seen that if two holes are brought in line to take a certain size of work all the other holes are out of line and therefore closed. To accommodate various sizes in this way the inside piece is turned around until both holes of the particular size required are



Hardening Small Tools with Acetylene Torch Is Aided by Flame Shield

brought together. The work to be heated is then inserted through these holes and can be turned by means of tongs, or held by hand. The danger of burns from the flame is entirely eliminated with this shield.

For tightening bicycle-spoke nipples, use an ordinary screwdriver with a slot in the center and of a width equal to the thickness of the spoke.

Cloud Effects on Drawings

In a studio where quantity of production was a prime factor an unusual method was resorted to for putting cloud effects on drawings. An ordinary sponge was cut

Cloud Effects Put on Drawings with Sponge Speed Up Production in Drafting Room

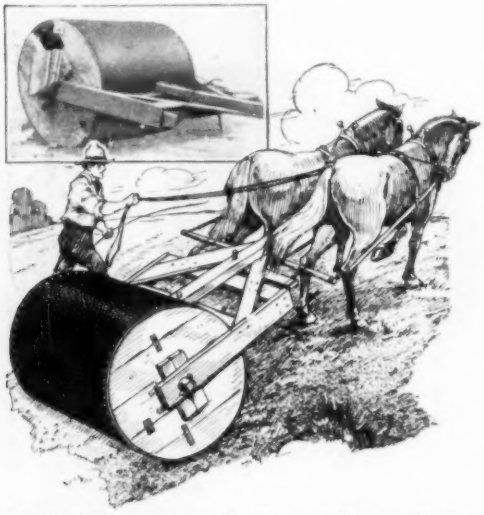
with a pair of scissors so as to leave several flat spots on the surface. India ink, diluted so that the color was very faint, was then applied to the drawing with a flat side of the sponge. In this way little spots of clouds were printed on the drawing. The sponge was, of course, turned around each time to prevent making each print identical. The objects on the drawing were protected by covering them with a sheet of paper cut to the same shape. Almost any cloud effect can be produced in this way in a very short time.—G. M. Beerbower, Tarrytown, N. Y.

Cementing Leather to Iron

To cement leather to an iron surface, paint the iron with a mixture of white lead and lampblack in oil. Then cover with a cement made of the best glue soaked in water until soft, and dissolved in vinegar. This is thoroughly mixed with one-third of its bulk of white-pine turpentine, and thinned with vinegar until it can be spread with a brush. The cement should be applied to the iron hot and the leather put on and quickly pressed into place; the parts should be held tightly in a clamp while drying.

Farmer's Concrete Mixer

Mixing concrete by hand was too slow and tedious a job for an Indiana farmer, so he made the novel horse-drawn mixer



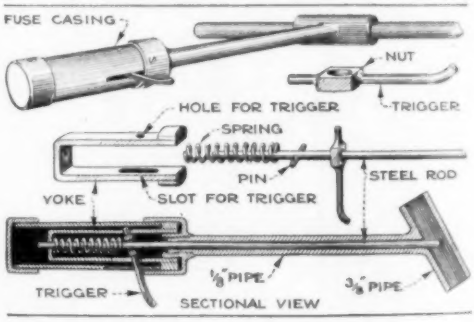
Metal Cylinder, Drawn by Team of Horses, Used to Mix Concrete

shown in the illustration. It consists of a large metal cylinder the ends of which are closed with 2-in. boards. A shaft of 1½-in. pipe is run through the center and a wooden frame is made, as shown, an ordinary doubletree being attached to it. A small opening is cut at one end to permit shoveling in cement, sand and gravel, in the proper proportions, and adding water, and a door is provided to close the opening. After these ingredients have been put in the door is closed and a team of horses is hitched on to roll the cylinder a few hundred feet, which thoroughly mixes the concrete. The end opposite the opening is driven up on a log or some other slight elevation to cause the mixture to run out as soon as the door is opened. If the concrete is to be used for foundation work, very little extra handling is necessary as the mixer can be driven close enough to run the concrete directly into the forms.—J. C. Allen, West Lafayette, Ind.

Handy Welding-Rod Holder

I do considerable welding along with other work, and was bothered a good deal by having to weld the end of one welding stick onto another in order to avoid waste and to prevent burning my fingers and gloves. In steel welding also the rod had to be bent to keep the hands away from the heat, so I made the holder shown in the drawing from old material, and it works splendidly.

The material used is one burnt-out 600-volt, 60 to 100-amp. cartridge-type fuse; one piece of ⅜-in. pipe, 1½ in. long; one ⅛-in. coupling; one piece of coil spring, 3 in. long; ⅛-in. pipe, 12 in. long; one piece of cold-rolled steel rod, 15 in. long to fit inside the ⅛-in. pipe; one piece of flat iron, ¼ by 1/16 in., 7 in. long, and scrap material for the trigger. To make the holder proceed as follows: Remove the caps from the fuse and push out the copper contacts from them; then fit the ⅛-in. coupling into one cap, as shown, and weld the cap and coupling together so that the coupling comes flush with the outside of the cap. File the end of the ⅛-in. pipe to an angle of 45°, then drill a hole in the center of the ⅜-in. pipe, fit the end of the ⅛-in. pipe into the hole, and weld. Make a yoke from the ¼ by 1/16-in. stock, as shown, the width being about ¾ in. over the outside, so that it will fit inside the fuse, drilling a hole in the back of the yoke to fit the cold-rolled rod, and a loose-fitting hole on one side for the end of the trigger. A slot is cut opposite this hole, through which the trigger works. Two small pieces of the same stock are welded to the tips of the yoke, to make it a neat fit in the cap in which the coupling was



A Welding-Rod Holder Made from Scrap Parts That Will Be of Value in Any Shop

welded. When fitted, the yoke is welded in place.

Cut the cold-rolled rod long enough so that it will touch the front side of the ⅜-in. pipe and pass through the hole in the yoke. Make a trigger, as shown in the detail, by welding two pieces of cold-rolled rod to a nut that will pass over the rod in the cap. The end of the trigger passes through the slot in the yoke, and a similar slot in the cap. The remainder of the assembly is obvious from the drawing.

To operate the holder, pull back the trigger and insert the welding rod in the angular pipe. Releasing the trigger causes the spring to push it forward and with it the steel rod, which locks the welding rod in the holder.—A. S. Jamieson, Springfield, Mass.

Making a Reamer Cut Oversize

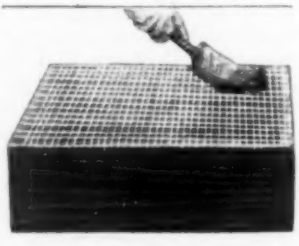
When a smooth round hole of small diameter is required, a hand reamer is used to produce it, and many times the reamer is from .001 to .004 in. undersize. The reamer may be made to cut oversize in the following manner: With a scraper made of a medium-size half-round file, burnish the face of each flute, using the oval side of the scraper. This will raise a burr and cause the reamer to make the hole larger by an amount depending upon how hard the faces were burnished. It does not make a permanent edge, but serves very well in an emergency.

Reversing a Single-Valve Engine

To reverse a single-valve engine put the crank on either dead center and scribe a line on the valve stem next to the stuffing box; loosen the eccentric and turn it on the shaft until the mark on the valve stem is again even with the face of the stuffing box. Then tighten the eccentric, and the engine will run in the opposite direction. Care should be taken not to move the stuffing box during the operation and to see that the crank is on the same dead center when tightening the eccentric as at the outset.

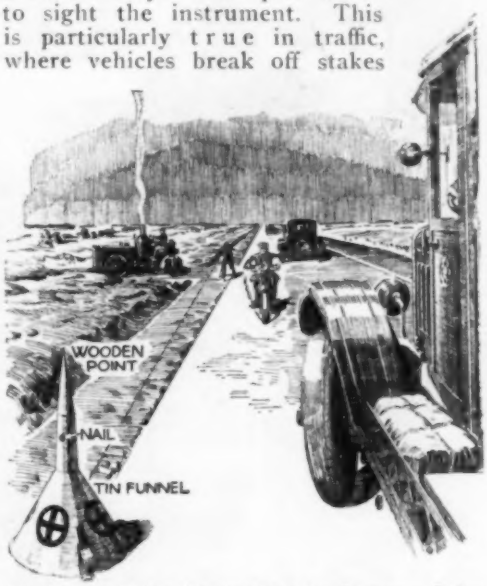
Working Paint from Brush

Paint is usually worked out of a brush by rubbing it on a board. The objection to this practice is that the paint accumulates and gives the board a smooth surface, which is not effective for the purpose. A better method is to rub the brush over ½-in. wire mesh, stretched and nailed over the open top of a box. This makes a handy accessory that every painter will appreciate.—J. H. Shadek, Oradell, N. J.



Useful Surveyor's Mark

Every surveyor engaged in running the level on paved streets and highways knows how difficult it sometimes is to establish a satisfactory mark upon which to sight the instrument. This is particularly true in traffic, where vehicles break off stakes or throw aside stones and other objects set up to be sighted. To them the method devised by Roger Sweier, an engineer with the Los Angeles county-road department, will prove of interest. He experienced endless trouble in maintaining surveying marks until he hit upon the idea shown in the illustration. A large tin funnel was painted white, and after the paint was dry, four black sighting marks were painted on the conical part, as indicated. Into the small end of the funnel he fitted a soft-wood stick, whittled to a needle point. Now, when out surveying for pipe trenches and similar work, he sets the mark down on the pavement wherever desired. It does not blow over in the wind and is seldom disturbed by traffic because of its visibility. Motorists have to strike the funnel squarely to damage it, but they do not do that because the dangerous-looking but harmless wooden spike suggests a puncture, so that, as a rule, they avoid it. The device is light, compact and always ready for use.—J. E. Hoag, Los Angeles, Calif.



Tin Funnel Makes Handy Mark for Surveyors Doing Street and Road Work

¶A good filler for cracks in stoves and furnaces is made by mixing equal parts of salt and wood ashes into a paste.

Novel Window Advertisement

A novel method of attracting attention to a window display was used by a druggist. To all appearances the plate-glass window had been broken and a wooden box, which apparently just fitted the hole, inserted in it to keep out the cold, while the cracks radiating from the hole had been covered with adhesive tape. All day groups of people gathered in front of the window, and, of course, could not help observing the merchandise in it, so that the druggist's sales increased considerably.

Novel Window-Advertising Scheme Attracts Attention of Curious Crowd and Increases Sales

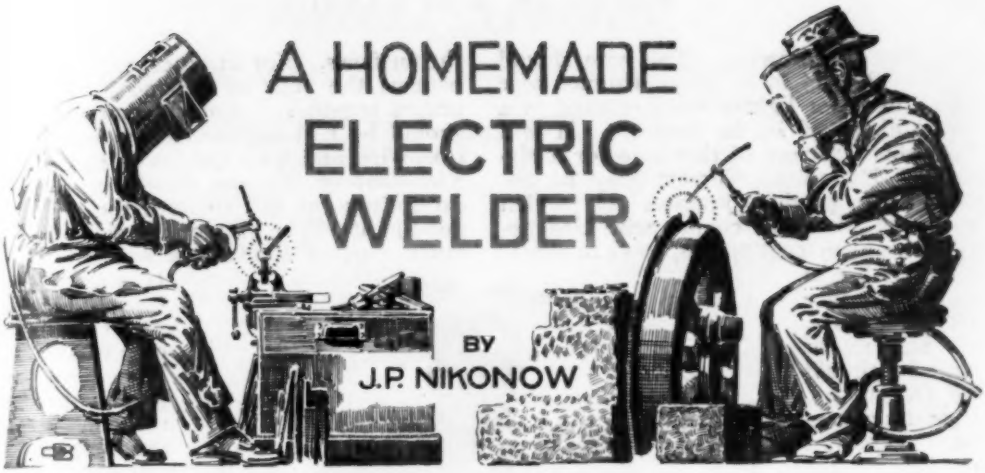
The window was really not broken at all, but the box was cut in two at a slight angle, and the parts glued to the glass, one on the inside and one on the outside. Dark-gray adhesive tape concealed the edges of the box and was pasted on the window, radiating from the box, to convey the impression of cracks in the glass. Tape was, of course, used on both the inside and the outside.

A Homemade Monotone Glass

To the amateur photographer colors seen on the ground glass of a camera are very deceptive and contrast with each other much more than their tones do on the negative. Seemingly charming views, clusters of brightly colored flowers, and the like, often prove disappointing after being developed. To see the true tone values of colored objects, a monotone glass is used, and anyone can easily make one himself. A piece of waste film, preferably cut film, which has been fixed in the hypo bath and thoroughly washed, is soaked in a tray containing enough blue fountain-pen ink to cover the film, which should be submerged long enough to stain the emulsion a deep shade. When this shade is obtained, the film is washed to clear it of surplus ink, and when dry, it is mounted between two pieces of clear glass, which are bound together with adhesive tape. Two small glass plates that have "missed fire" can be dyed blue and bound together in the same way, the emulsion sides being in contact. However, when plates are used, they should not be given such a deep blue tint as when a single film is used, as the depth of the shade when the plates are laid together will be doubled. When the subject of the picture is viewed through the monotone glass, it appears as it will in the print, in black, white and half-tone, so that the effect can be judged much more accurately than when the ground glass only is used.—M. E. Hopkins, Corry, Pa.

¶About as good a belt dressing as can be had is made by mixing melted beeswax and neat's-foot oil in the proportion of ½ lb. of wax to ½ gal. of oil. Melt the wax first, then add the oil slowly, stirring constantly to get it thoroughly mixed.

A HOMEMADE ELECTRIC WELDER



BY J.P. NIKONOW

ELECTRIC welding, while it has certain limitations, in many respects is much superior to acetylene welding. We all have heard of the wonderful work of repairing what appeared to be hopelessly damaged engine parts on big German liners. Complete new portions of cylinder walls had to be made in some cases, welded into places and finished smooth inside for the piston. All this work was done with the help of the electric welder.

Of course, the apparatus for this kind of work is bulky, expensive and requires great electrical energy. But it is possible to construct a simple and light portable electric welder that can cover a large range of jobs on light pieces of metal.

The apparatus described here is of the arc-welding type, as it utilizes an arc flame to produce the high temperature. For this reason, it might also be called an "electric torch," the arc having actually the effect of the hot flame of a torch. It may be used for a variety of work, not only welding, but also brazing, etc. This welder consists of two carbons of 5/8-in. diameter, such as are used for arc lamps but without cores (the cores produce too much smoke and are generally undesirable for welding service). The carbons are held in clamps, F, attached to the ends of holders, D and E; D is made of a brass strip, 3/32 by 1/4 in. and about 8 in. long. The holder D is placed between blocks, A and B, of hardwood or fiber and is clamped with 8-32 machine screws (8-32 screws are used throughout for this device). The screw heads should be sunk in counterbores, so that they cannot come in contact with the operator's hands. The other holder E is made of a lighter strip, 1/16 by 1/2 by 8 in., and is fastened to the block B with screws and nuts. These (and all the other) nuts should be sunk in the counterbores so as to prevent any possibility of a short circuit. A piece of wood, C, is fastened to the holder and forms a convenient handle. It should be wider than the strip (Fig. 2), to keep the operator's hand from touching the metal of the holder. The latter is bent outward, so that normally there is a large clearance between the ends of the holders D and E, also about 3/4-in. clearance between the tips of the carbons. This strip E should be made of hard or spring brass; then it will stay in its bent-out position, and the carbons will come together only when the operator squeezes together the handles A and C. The rear ends of the strips are provided with contact screws, under which the ends of the cables 13 are clamped. These cables are made of rubber-insulated stranded copper wire of about 4,000 or 5,000 circular mils. The contact screws with the wire ends and the rear end of the welder are protected with a double layer of insulating tape.

This welder can be used with direct or alternating current. When using direct current, it is necessary to use a rheostat, R (see diagram Fig. 9). The current should be adjusted for about 10 amp. for lighter work, and for about 20 to 30 amp. for heavier work. For light work, 15-amp. fuses should be used, and a 50-amp. fuse for heavy work. Heavier wires should also be used for stronger current. Fig. 3 represents the strip D; Fig. 5, strip E; Fig. 4, clips F before bending; Fig. 6, central wooden block B; Fig. 7, block A, and Fig. 8, block C. Fig. 9 represents diagrammatically electrical connections from the line and fuse to the welder W, with rheostat R connected in series with one of the wires.

The rheostat (Fig. 10) can be easily built on a 24 by 24-in. wooden frame and a long spirally wound iron wire supported on porcelain insulators. Dimensions are

given on the drawing. The wire should be from No. 14 to 16 gauge, thinner wire being used for lighter work, wound in a spiral about ¾ in. in diameter. It will take about 50 feet of this wire for a circuit of 110 volts. Current may be adjusted by placing jumpers 13, which represent pieces of copper wire tied between two adjacent spirals, so as to short-circuit them and to reduce the resistance. At first all of the wire should be included, then the carbons drawn quickly together and apart again. A good arc will be maintained with about 10 amp., with the carbons from ⅛ to ¼ in. apart. When the carbons are close together, the arc will draw more current, and will be hotter and shorter. In this condition it is more suitable for welding small pieces of iron or cast iron. Soft iron and steel weld the best; harder steel does not weld so readily. Nails are much harder to weld than a soft-iron rod or sheet iron. The arc concentrates at the tips of the carbons and flame from it plays outward, so that it can be used very conveniently for heating pieces to be welded. With increased distance between the electrodes, the current decreases, and the arc lengthens and becomes unstable. It is difficult to maintain the arc at currents below 5 or 4 amp. Smaller diameters of carbon are not satisfactory, even for very light work.

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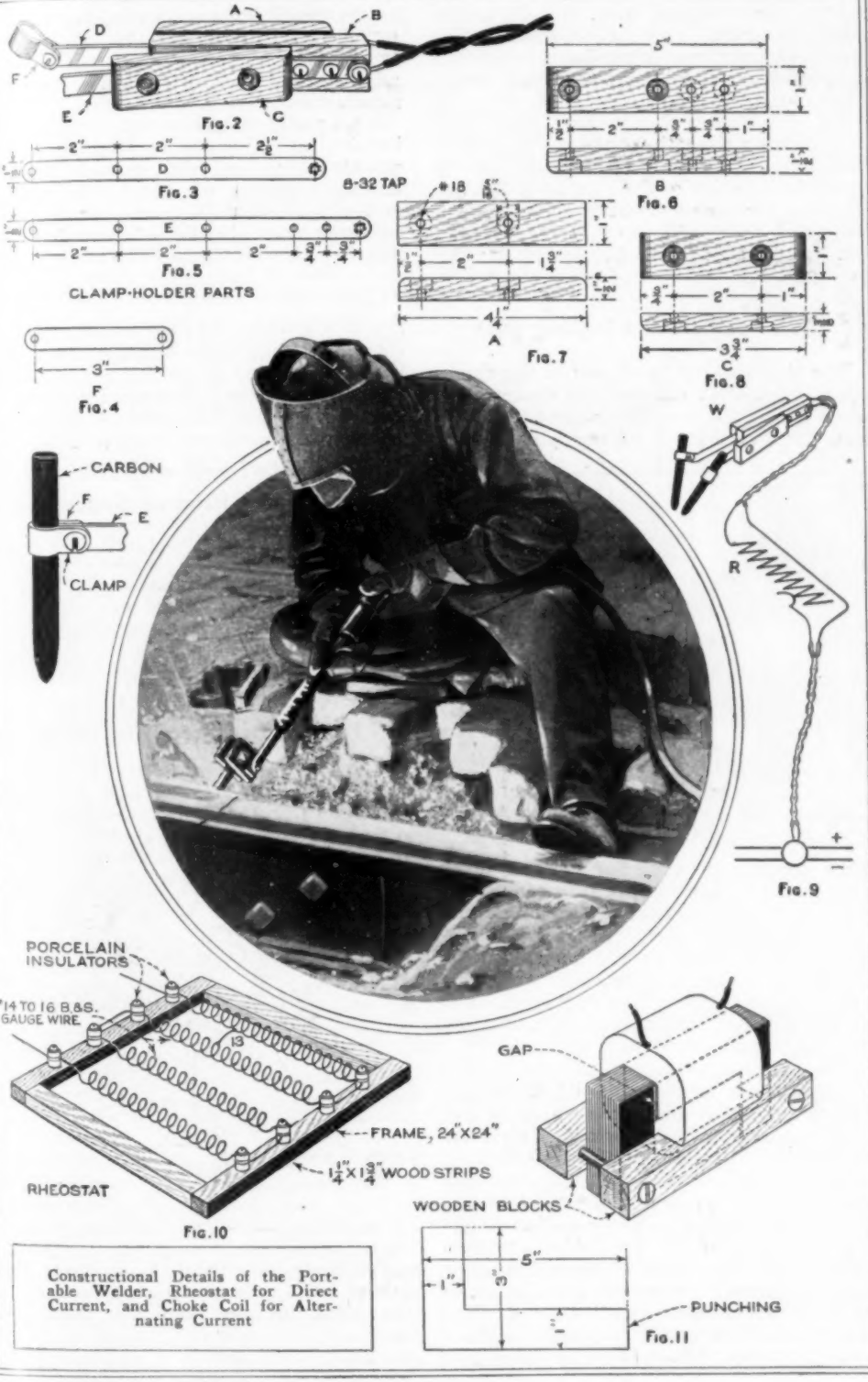
Fig. 1—Assembly View of the Portable Electric Welder. This Is an Easily Made Tool and One of Considerable Usefulness

It is not necessary to use any flux when welding pieces of iron. But the same apparatus may be used for brazing, in which case powdered borax should be used on the surfaces. For instance, with this apparatus the ends of a bandsaw may be brazed together. For this purpose they should be tied together by means of an iron wire, and then the borax spread on. The heat of the arc should be applied carefully so as not to burn the saw. A good joint will be obtained by this method much quicker than by a regular torch.

It is absolutely necessary to protect the eyes with dark-blue or red glasses, the red glasses being better because they stop most of the very injurious ultraviolet chemical rays. When working for any length of time—say, a few hours at a stretch — it is necessary to employ a mask for the face, otherwise, the chemical rays from the arc will cause severe burns on the skin, like a bad case of sunburn. The same rheostat may be used for an alternating current of 110 volts. It has the disadvantage, however, of uselessly wasting a considerable amount of energy, dissipating it in heat. A much more efficient arrangement can be made with alternating current by using a choke coil instead of a rheostat. The choke coil lowers the voltage without wasting energy. Or a still better arrangement would be the use of an auto transformer, which not only saves the energy, but can actually give more amperes than the main fuse will stand (the auto transformer converts the electrical energy of high voltage and low current into a low voltage and high current with but little loss). For ordinary practice, a choke coil will be sufficient. It can be made



Constructional Details of the Portable Welder, Rheostat for Direct Current, and Choke Coil for Alternating Current

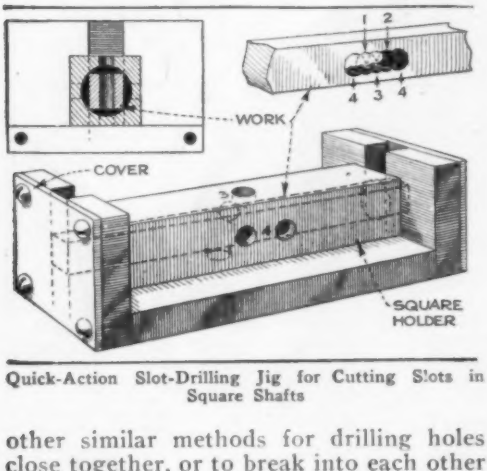
Photo Copyright, Underwood & Underwood

easily (Fig. 11) by making a coil of insulated d.c.c. copper wire, No. 10 gauge, about 80 turns. This coil should then be taped all over, and sheet-iron punchings assembled in it, forming a closed "ring." The L-shaped punchings used for two sides of the ring should have their long legs shorter than the ones on the other two sides, so that a 1/64-in. gap will be found on one side of the ring, as indicated. Without this gap the choke coil will have too much reluctance, so that there would not be enough current in the line for the arc. By changing the gap the coil may be regulated for any current desired. The punchings should then be clamped between two wooden blocks with screws, and the coil heavily coated with an insulating varnish.

This welder represents a very interesting device, and it can be used with a little practice for some very remarkable work on light pieces of metal, wires, bolts, sheets, etc. But it cannot be used successfully for heavier jobs, such as the welding of cracks in a cylinder.

Quick-Action Slot-Drilling Jig

The slot-drilling jig shown in the drawing is somewhat different in design, and much quicker in action than the usual type. Eccentric bushings, sliding pieces, and other similar methods for drilling holes close together, or to break into each other to form slots, are generally slow in action; but as many different holes as are necessary to form a slot of any length can be drilled by using this jig, and only one movement is required between holes. The job for which it was used was the cutting of a slot in the middle of a square shaft.



Quick-Action Slot-Drilling Jig for Cutting Slots in Square Shafts

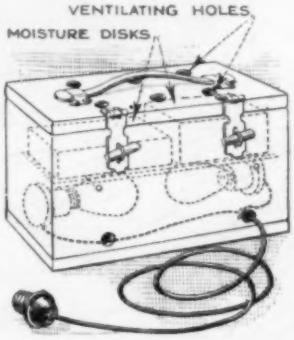
The main part consists of a base with two endpieces screwed to it; these are slotted in the center to the size of the shaft, and afterward thin metal covers are screwed to the outside faces. Next a square holder is cut to fit nicely between the endpieces and drilled along its axis to suit the corner-to-corner dimension of the shaft. The sides of the holder are then drilled and reamed as indicated to take the drill and counterbore necessary to make the slot. This is done in the following way: Hole 1 is drilled first; the holder is lifted enough to clear the bottom of the jig so that it can be turned over to bring the next side uppermost, when hole 2 is drilled. The holder is turned again and a counterbore used to drill hole 3 between the two holes just drilled. The half holes, 4, at each end are then cut with the counterbore.

Cleaning Paint on Engines

A compound with which engines or other oily machinery can be cleaned thoroughly is made as follows: To 1 gal. of water add ¼ pt. of lard oil. Mix them thoroughly, forming an emulsion. Rub the painted surfaces with the compound and remove it before it dries with a cloth.

Electric Drier for Kiln Samples

The U. S. forest products laboratory at Madison, Wis., has devised a portable electric drier for moisture-determination disks. It consists of a sheet-iron box, 4 by 13 by 6¾ in. in dimensions, lined with a layer of ½-in. asbestos, and divided into two compartments by a wire rack. The heat is supplied by two 40-watt carbon-filament lamps, placed in the bottom compartment, the sockets being screwed to the sides. Ventilation is obtained by eleven holes, ⅜ in. in diameter; six of these are drilled in the cover, three in the back near the bottom and two in the front. A cord and plug attachment makes it possible to connect it to any available lamp socket.



The 1-in. wooden disks used in moisture tests are easily dried in this box in about 24 hours. The maximum temperature attained is 230° F., which is reached only if the disks are allowed to remain in the drier for several hours after they are bone-dry. A slight scorching of the disks occurs under these conditions, but for all practical purposes this does not cause any appreciable error in the moisture calculations. The weight lost by the disk in drying is the weight of the moisture that was in it. This weight, divided by the weight of the dry disk multiplied by 100, gives the percentage of moisture in the stock in the kiln at the time the sample was removed. This drier is very well adapted to commercial practice. It can be carried around and used in any place where a lamp socket is available.

Effective Post Puller

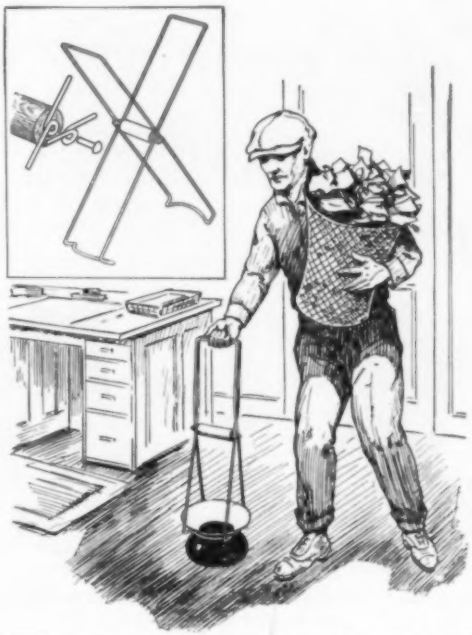
Of all the post-pulling devices I have ever seen, the one shown in the illustration is the simplest and quickest-acting. It consists of a discarded sleigh runner, provided with a clevis, chain and a doubletree so that a team of horses can be hitched on, and a wooden lever with a sharp steel point, bolted to the runner as shown; in this particular instance the point was the tip of a discarded plowshare. To pull a post, the runner is placed close beside it with the point of the lever driven into the post as shown. When the

Simple Device Pulls Out Row of Posts in Rapid Succession

horses are then urged ahead and the runner slides forward, the lever pulls out the post. This operation is repeated for each post. The absence of loose parts and the elimination of tackle and chain make this device well worth the time and labor necessary to make it.—G. E. Hendrickson, Argyle, Wis.

Handy Cuspidor Carrier

Janitors of public buildings can make the task of collecting and carrying cuspidors much easier by using a holder of



Cuspidors Can Be Conveniently Carried Around with This Wire Holder

the kind shown in the drawing. It is made of stiff galvanized-iron wire, bent to the shape indicated, and a small piece of wood, with a pin driven in at both ends, to serve as a pivot for the jaws. In use, the jaws are hooked around the neck of the cuspidor and the opposite ends brought together; this causes the jaws to grip the cuspidor tightly and it can then be carried away.—A. C. Cole, Chicago, Ill.

Removing Compression Sleeves from Tubing

The cones or sleeves used on automobile tubing become firmly fixed after being used a few times. This results from their compressing the tubing directly under them, while leaving it the original diameter on both sides. Such sleeves are applied from 3/16 to ½ in. from the open end of the tubing and can easily be removed by slitting the tubing into quarters lengthwise and pressing the ends together. If the sleeves cannot be pulled off by hand after this treatment, pliers may be used with care.—E. T. Gunderson, Jr., Humboldt, Iowa.

Improvised Sheet-Iron Cutter

The writer discovered the homemade sheet-iron cutter shown in the drawing in a small country shop, where it had orig-

An Improvised Sheet-Metal Cutter That Has Proved of Value in a Small Shop

inally been hastily made to cut up a lot of old roofing into sheets of suitable size to use for the same purpose on another building. Since that time it has come in handy many times, and for iron of light weight, it is rapid, reliable and convenient to use, besides being very simply made.

Two harrow disks form the cutters. These are mounted on heavy shafts running in holes bored through the ends of heavy uprights made of maple. For a permanent construction, of course, it would be necessary to use bushings in the holes. The shafts are so mounted that the edges of the disks overlap about 1 in. The upper shaft carries a heavy coil spring that bears against a collar and keeps the upper disk against the one below. On the end of the lower shaft is fitted a large wooden pulley, which is belted to an overhead shaft to drive the disks at a speed of about 10 revolutions a minute. The upper disk revolves without the aid of a belt.—D. R. Van Horn, Walton, Nebr.

The addition of phosphorus and manganese to molten bronze purges the metal of metallic oxides, and produces an alloy of greater purity and strength.

Attaching Brass Valves

In screwing iron pipe into a brass-body valve, little or no pipe-joint compound need be used, as the brass is softer than iron and gives enough to form a tight joint. If white or red lead or pipe-joint compound is used, it should be placed on the pipe end rather than in the valve, so that it will not be carried by steam to the bearing parts of the valve where it may catch and hold scale and grit on the seats and disks.

Wrenches or tongs should be placed on the hexagon nearest the pipe end when screwing brass valves onto pipe; otherwise they are apt to spring the seats out of line. When screwing pipe into gate and other valves always close them tightly to make the bodies rigid.

Preserving Color of Copper Trimmings

For preserving the color of copper trimmings, such as cornices and leaders, there is probably no better application than boiled linseed oil, to which is added a small amount of Venetian red to give it color, but not enough to make it a paint. For coloring the copper to a dark brown, a solution of one ounce of sulphate of copper, one ounce of hypophosphate of soda and two drams of muriatic acid to one pint of water, or larger quantities in the same proportion, may be used on the copper surface once or twice, and the color can then be preserved by a coating of boiled linseed oil.

Repairing Glass Graduates

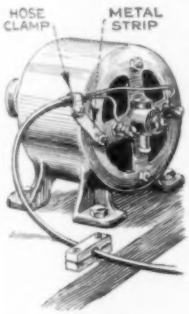
Although the small sizes of glass graduates which are used extensively by photographers and chemists, are not expensive, there are times when it is worth while to repair them if possible, especially if they are needed at once.

One common occurrence is a broken base, so that the glass will not stand. A good repair is as follows: Two concentric circles are scribed on an old phonograph record, the inner one equal in size to the bottom of the graduate and the outer one to its top. The circles are cut out with a fine saw and a radial slot is cut from one circle to the other. The piece of record thus cut

is warmed up on a greased iron plate until it is sufficiently flexible to be bent with the fingers. It is then bent into place about the glass, a wedgelike section being whittled out along the slot so that when the adjacent edges are brought together a cone is formed. These edges are fused together by means of a hot stove-lid lifter or poker. After the cone has hardened, the graduate is put on the table, bottom side up, and melted sealing compound, such as is used in storage batteries, or ordinary sealing wax, is poured into the cone to make a solid base. This heats the whole mass so that it can be formed to the correct shape and the bottom pressed flat against a level surface. The compound left on the edges is trimmed off with a wet knife. It is obvious, however, that graduates repaired in this way should not be left in hot places, nor should hot liquids be poured into them.—Chas. M. Doten, Plymouth, Mass.

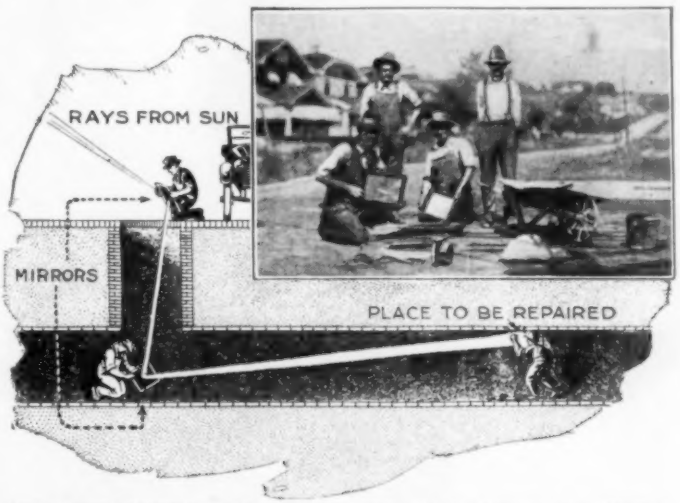
Taking Strain off Motor Leads

The leads to small electric motors are often subject to considerable strain where they are connected to the motor terminals, and this causes the wires to break or become loose. A simple method of eliminating this trouble is to wrap the cord with tape and then clamp it securely to the motor or to the base on which the motor is mounted. Both methods are shown in the drawing. If the motor is portable, a metal strip and a small hose clamp are attached to one of the screws holding the end plate of the frame, and the hose clamp is tightened around the cord. If the motor is attached to a wooden base, as is often the case, a small wooden clamp, consisting of two pieces, notched in the center to hold the cord, is screwed to the base.—E. T. Gunderson, Jr., Humboldt, Iowa.



Mirrors Used in Repairing Sewers

Minor repairs in sewers or in other underground conduits, can often be made much more easily with the aid of reflected sunlight. Two mirrors are used; one at the street surface and the other one in the sewer at the foot of the manhole, a beam of light being directed as shown. This method gives better illumination than flashlights.—Ivan E. Houk, Denver, Colo.



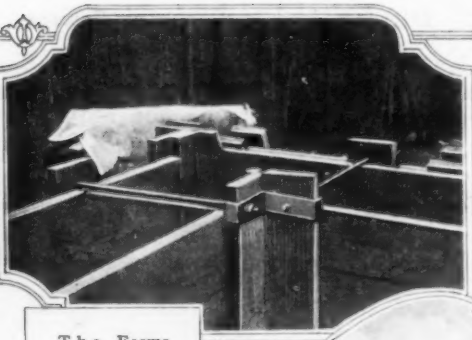
Sun's Rays Reflected Inside of Sewer with Aid of Mirrors Give Workers Plenty of Light

An Inexpensive Universal Joint

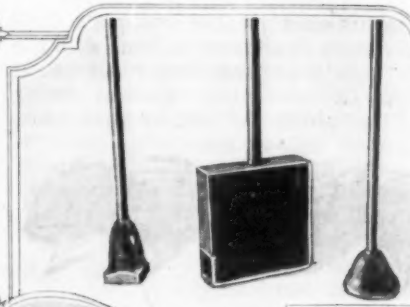
In light and medium-heavy machinery, a cheap, durable and efficient universal joint may be made from three straight chain links of round section. In connecting this form of a joint, the ends of the shafts must be slotted to receive the end links, and a bolt put through each to prevent the links from pulling out. A reinforcing collar is shrunk over the end of the shaft to strengthen the slotted part. Such a joint will drive at almost right angles and with very little friction.

Hardening Thin Steel

Thin strips of steel that must be hardened are difficult to handle without causing them to warp. A method used in a small shop for hardening saw blades, and which is applicable to other jobs of the same nature, is to clamp the blade between two heavy pieces of cold-rolled steel or iron and heat and quench the whole.



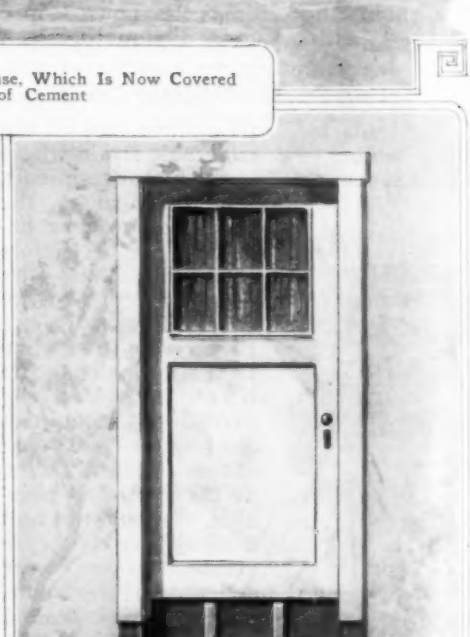
The Forms Are Stronger and More Rigidly Fastened and Braced than for Concrete Walls



The Rams Are Made of Beech and Oak Root

General View of the Earth House, Which Is Now Covered with a Coat of Cement

Setting the End Board into the Form; Note Solid Construction



The Trim Is Fastened to Planks Held by the Rammed Earth

Rammed Earth Lowers House Cost

By G. H. DACY

A WASHINGTON scientist has lately built a new style of house with walls of rammed earth, at a great saving over all other forms of permanent construction, thus reviving a building style of the ancient Greeks and Romans in order to curtail construction costs.

This home builder made a careful study of all the books he could find in our national libraries pertaining to "pise de terre" or rammed-earth houses. Then he communicated with builders in England, South Africa and New South Wales, where such houses are still in use. He learned all about the rudiments and advantages of such construction. Employing a trio of unskilled laborers who had never previously even heard of rammed-earth walls, he then embarked on his building adventure. Rammed-earth houses are cool in summer, warm in winter, vermin-sound and rat-proof, fireproof, weatherworthy and the cheapest durable structures that can now be built. The process is free to all, as it is unpatented.

The Walls of This House, Built by a Washington Scientist, Are Made of Rammed Earth at a Great Saving over Concrete, Brick or Wood

The building material is the earth excavated in digging the basement. Strong wooden forms are built similar to those used in concrete work, as the accompanying illustrations show. A mixture of loam and clay is best, with not more than one-fifth of the latter material, as too much clay makes the walls crack easily after they are dry. The top six inches of soil are discarded. The remainder of the soil is carefully screened to remove all large stones, vegetable matter and other organic material. A layer of the soil, 4 in. deep, is then shoveled into the form. The workmen, armed with 15-lb. rams, made of root wood of oak or beech and shod with metal plates, then tamp the soil firmly in place until it is reduced to one-half its original volume and rings when struck with the rammer. Then another layer of soil is added and compacted. Three men can build two cubic yards of pise wall in eight hours, at a labor cost of $10. As soon as one course of wall is completed, the three-foot forms are raised and work on the next course is begun. The walls of the Washington house are 18 in. thick and 12½ ft. high. The house is 32 by 48 feet in floor dimensions. When rammed earth dries, it has the strength of reinforced concrete. A technical test of the pise from the soil used showed that a column of rammed earth, 18 in. square and 42 in. high, after drying for 16 days had a crushing strength of 18½ tons. A small block, 1¾ in. in diameter and 2 in. high, supported 280 lb. before it fractured. When the walls were finished, the owner desired to bore a small hole. He tried an auger, but it had no effect. Finally, he had to resort to a hammer and cold chisel and found that the task was as difficult as though he had attempted to cut through a stone wall. According to the home builder's experiences, pise gives an absolutely solid-walled house at about one-fourth the cost of a similar brick structure, one-half the cost of a concrete one, and seven-tenths that of a substantial frame building. Pise becomes stronger as years pass and finally turns as hard as stone. The oldest home on the American continent, built in 1556 in St. Augustine, Fla., is made of rammed earth. Hannibal built fortifications and watch towers of rammed earth in Africa and Spain, in 124 B. C., which are still standing and durable. Lyons, France, a city internationally famous for its venerable buildings, consists in large part of rammed-earth structures. In England are many homes which have been used for four to five centuries and are still habitable and weather-resistant. Thomas Jefferson, more than a century ago, investigated the possibilities of using pise construction in the United States. He found it practical and urged his friends

and neighbors, and the colonists at large, to build rammed-earth walls. The forests were thick, however, and logs were abundant, so the settlers elected to build of wood instead of earth.

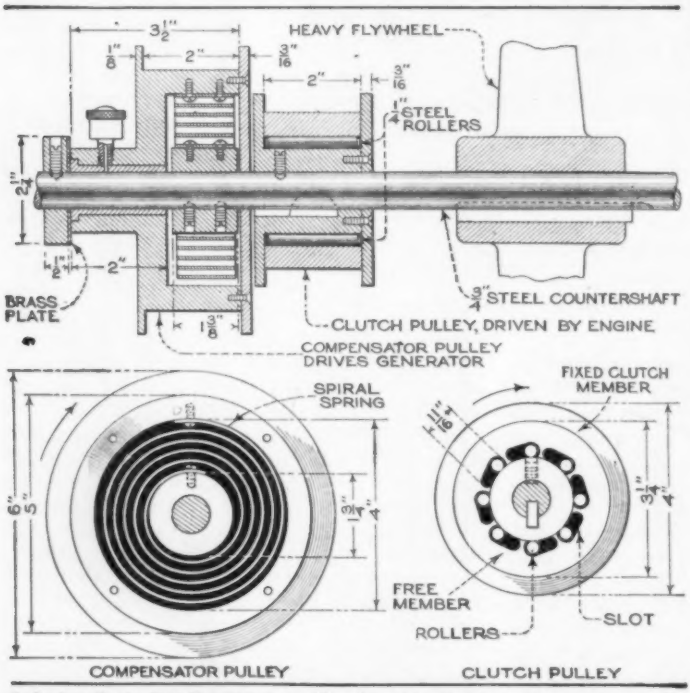
Pise houses are best built on concrete or masonry foundations, although the basement partition walls that carry the beams may be of rammed earth. The walls can be carried safely to a height of 50 feet. The first floor wall should be 18 in. thick, the second floor 14 in., and thus the walls can be tapered to a minimum thickness of 10 in. After drying, the exterior of the wall should be weatherproofed with a mixture of lime and tallow, cement wash or hot tar. Plaster can be applied directly to the inside walls and will adhere better than to wooden lath. Molding, mopboards and other woodwork may be held in place by the rammed earth, as there is no danger of the wood rotting. Wood taken from wrecked pise buildings in Europe has shown no damage from wear, worms or decay after two centuries of use.

Building contractors furnished bids on the brickwork on the house made of earth, the lowest of these estimates being $3,800. The actual cost of the rammed-earth walls of this building amounted to $1,800. By reviving a system of construction which is as old as the most ancient Roman ruins, this Washingtonian made a remarkable saving in construction costs and has paved the way for other house builders to do likewise.

Compensating Clutch for Driving Generators

When driving a small d.c. generator directly from a one or two-cylinder 4-cycle gasoline engine the lamps alternately brighten up and become dull, respectively, at the explosion and compression strokes, and unless these changes take place at a rapid rate the effect is very tiresome to the eyes.

This trouble can be eliminated by means of the compensating clutch shown in the illustration. It is a separate unit driven by the engine and in turn drives the generator. The compensating action is accomplished by means of a spiral spring made from two phonograph springs in tandem, riveted together at their ends and screwed to the core and shell of the compensator pulley, as shown in the lower left-hand detail. These springs are strong enough for loads up to 1 hp. When the engine speeds up on the power stroke the excess energy is stored up in the compensating spring instead of being transmitted to the generator, and when the engine speed is retarded at the compression stroke, this energy is expended; the action of the spring thus keeps the generator running at a constant rate of speed. The whole assembly, including a pulley driven by the engine, the compensating pulley which drives the generator, and a heavy flywheel, are mounted on a countershaft which is placed between the engine and the generator and is belted to both. The rollers of the clutch are made from drill-rod stock. The entire assembly should be made of steel and the clutch members should be casehardened on the friction

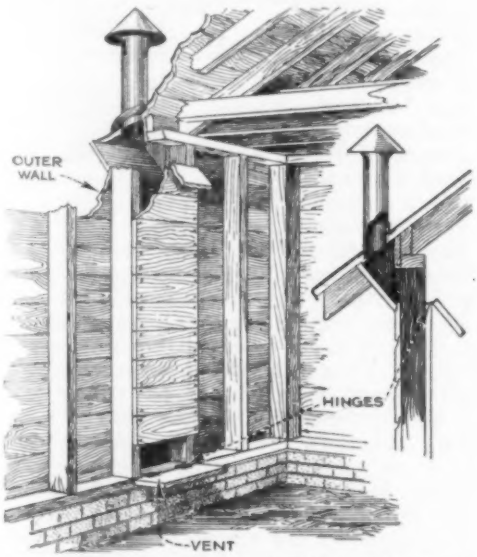


A Spring-Controlled Compensating Clutch on Countershaft with Separate Flywheel Prevents Fluctuation of Lights Connected Directly to Generator

surfaces, the parts being held together by setscrews or by steel keys. The particular design and dimensions given are suitable for a 500-watt generator, and only a slight alteration is necessary for larger sizes. The pulleys are faced with leather to prevent slipping, this facing being fastened by means of flat-head countersunk screws. The flywheel should weigh 40 lb. for a 1-hp. engine, and 100 lb. for a 2-hp. engine, and the size of countershaft should be ¾ in. for a 1-hp. and 1 in. for a 2-hp. engine.—A. N. Capron, Quebec, Canada.

Ventilating the Barn

Most barns are poorly ventilated, and this is both bad policy and a discredit to the owner. In cases where provision for ventilation has not been made when the barn was built, the arrangement shown in the drawing can be installed. The space between two studdings of the outer wall is boarded up, a vent being left at both top and bottom, which can be closed by means of a hinged board whenever necessary. A hole is cut in the roof above the boarded space, the plate over the studdings being avoided by the construction shown in the detail. A sheet-metal pipe, 4 to 6 in. in diameter and provided with a hood, is attached to the roof over the hole. The vents can be closed or opened according to weather conditions.—Robert Page Lincoln, Minneapolis, Minn.



Proper Ventilation in Barns Provided by Means of a Simple Installation

Novel "Free-Water" Curb Hose

Neat appearance and protection against wear feature the "free-water" hose arrangement for a garage shown in the drawing, as contrasted with the common method. It is constructed and installed as follows:

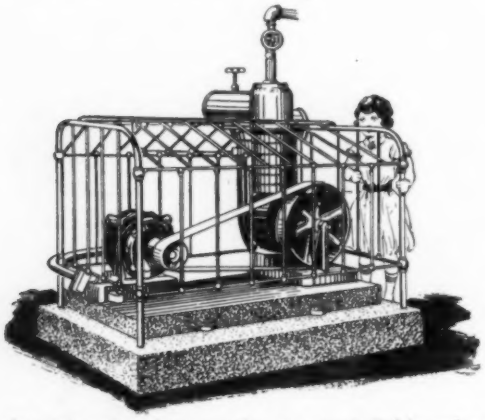
Novel and Convenient Curb Hose for Filling Automobile Radiators

The pipe from the underground water main is brought up to 1 in. above the surface of the curb, where a coupling is attached. A discarded harrow disk is placed over this, covering the handle of the winter shut-off valve, and a 2-ft. length of pipe is inserted through the center hole of the disk and screwed into the coupling. A locknut, with the threads filed out so that it will slide easily over the pipe, is put in place against the disk, and after a suitable length of hose with a faucet on the end is attached, a stout coil spring is slipped over both hose and pipe as shown. With this arrangement the hose is held upright or nearly so, and out of the way when not in use, while at the same time it is easily bent so that the faucet end will reach the filling cap of the radiator. During cold weather the harrow disk can be raised to close the shut-off valve.

For general purposes in the home workshop it will be found that ordinary water glass (silicate of soda) is an excellent glue. It has also many uses as an adhesive and therefore should be kept on hand.

Baby Crib Serves as Machine Guard

When an inspector visited an eastern hospital, he objected to the open installation of the brine pump, with its motor and

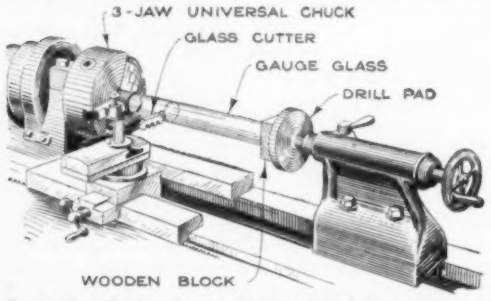


Old Baby Crib Used as Guard around Refrigerating Machinery in Hospital

belt, in the refrigerating plant, and called attention to the law requiring a suitable covering for such machinery as a safeguard against accident. As the hospital is a charitable institution and depends on state aid, its expenditures must be economized, and for this reason it was desirable to avoid the cost of guard rails, etc. A simple solution to the problem was found by setting up a discarded baby crib around the apparatus, as shown. The same method of protection can be employed on farms, where the engine and generator of the electric-lighting plant are usually found in an unguarded condition in the basement.—Edmund A. Knoll, Erie, Pa.

Cutting Gauge Glasses on Lathe

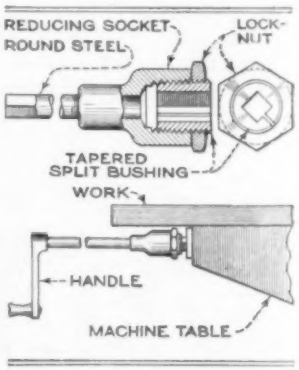
Gauge glasses for showing the height of liquid in tanks and boilers are usually cut to length by hand, with one of the simple glass cutters that are to be had on the market. But, when glasses are to be cut in quantities it is better to rig up a lathe for doing the work, as shown in the drawing. A drill pad is placed in the lathe tailstock spindle and the long piece of glass tubing is chucked lightly but firmly in the three-jaw universal chuck. Actual experience has proved that leather strips under the chuck jaws will prevent breakage better than felt, which is generally used. A heavy glass cutter is then placed in the toolpost and set in the right position when the carriage is clamped to the shears. A piece of wood is then put against the drill pad and the glass pushed against the wood firmly. Only one revolution of the spindle is necessary and this can be made by hand. After the glass has been nicked in this manner, a sharp, light tap on the end of the tube with the wooden block is all that is necessary to make it break off cleanly at the cut. If, for any reason, the glasses are cut too long they can be shortened by grinding them on a sandstone wheel, using plenty of water.



Lathe Set Up for Cutting Quantities of Gauge Glasses into Any Desired Length

Extension for Machine Handle

It is often necessary to use an extension piece on the end of the feed screw on a hand milling machine so that the handle will clear a piece of work of unusual shape. An extension piece used for this purpose is shown in the illustration. It can be tightened up on the square of the feed screw, which eliminates the annoyance of the device working off the square while in use, as is apt to occur with the usual extension. The piece consists of a reducing socket, a locknut, a taper-threaded bushing, and a length of round steel rod. The bushing is drilled and squared out to fit the feed screw of the machine, then sawed in two with a hacksaw. The rod is screwed tightly into the small end of the socket and the other end squared to fit the handle. When tightening the extension piece in place it is slipped on the square and the table locked. The handle is then turned, which tightens the socket on the split bushing, the latter gripping the square. The nut is then screwed back against the face of the socket.—Harry Moore, Montreal, Can.

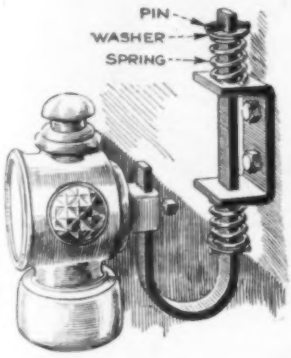


Corking Painted Ironwork

Sweating or condensation of vapor on the surface of ironwork may be prevented on ships and other structures which are in or near the water, by applying a layer of powdered cork over the paint. Several coats of red lead are first applied, and while the last coat is still wet, as much finely ground cork as the paint will absorb is dusted on. When this is dry a final coat of paint mixed with turpentine is applied. This method may also be used for protecting iron or steel roofs from moisture on the underside.

Spring Bracket for Truck Tail Light

Drivers of trucks equipped with solid-rubber tires and oil-burning tail lights, frequently find the light out after driving for a short distance. This trouble is caused by the thumping of the solid tires and can be prevented by mounting the light on a shock-absorbing spring bracket as shown in the drawing. The bracket is made of flat iron; one piece has both ends bent over at right angles and is bolted or screwed to the truck. The other part is bent to a U-shape with one leg longer than the other so that it can be passed through the first piece, slots being cut for this purpose. Small holes for pins are drilled in the U-shaped piece to hold short coil springs as indicated. The bracket is then assembled and the lamp is securely bolted on.

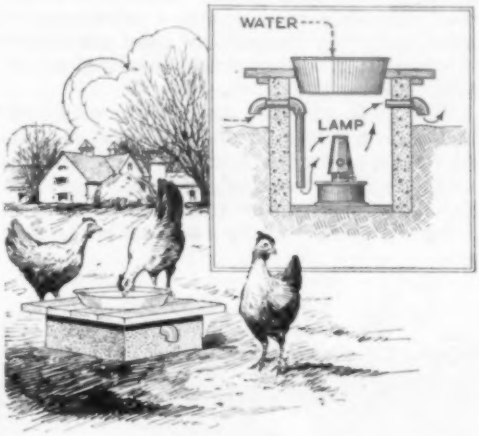


Cement for Metals

A very good cement for uniting metal parts consists of 2½ parts zinc oxide, 1 part zinc chloride and 5 parts pulverized limestone and slag. The whole is mixed to a thick paste with water. If a slow-setting cement is desired, use 1 part of zinc sulphate instead of the zinc chloride. The adhesive power of this cement may be increased by adding 2 per cent of ferrous sulphate to the whole.—Frank N. Coakley, Buffalo, N. Y.

Non-Freezing Water Dish for the Poultry

A non-freezing water dish for the poultry is a necessity in late fall and winter, and it is a very simple matter to make one.



A Simple and Effective Non-Freezing Water Dish for the Poultry House

As shown in the drawing, a pit is dug, in the ground or poultry-house floor, to a depth sufficient to accommodate the lamp it is intended to use, and lined with concrete, the concrete extending upward to a height of about 10 in. above the ground. Through one wall, a pipe fitted with two elbows and a long nipple is placed, while the opposite wall carries a short pipe that merely extends outside, although it may be fitted with an elbow with the outlet turned down. The outside elbows prevent dirt from being scratched into the pit. Over the opening is placed a tight-fitting wooden cover, in which a hole is cut to fit the drinking pan snugly. The heating element is an old incubator lamp. A very small flame will keep the water warm even in zero weather. Fresh air follows the long pipe to the bottom of the pit and the hot air and gases pass out of the short pipe. There is room enough on the platform for a number of fowls, but, because of the height of the pan above the floor, no litter can be tossed into the water.

Remedy for Overheating Bearings

Persistent overheating of bearings that are in constant duty may be overcome by applying a paste of flour of sulphur mixed with lubricating oil. This permits the use of an oil cup. The mixture will also be found useful on heavy-duty bearings in cam rolls and similar machine parts.

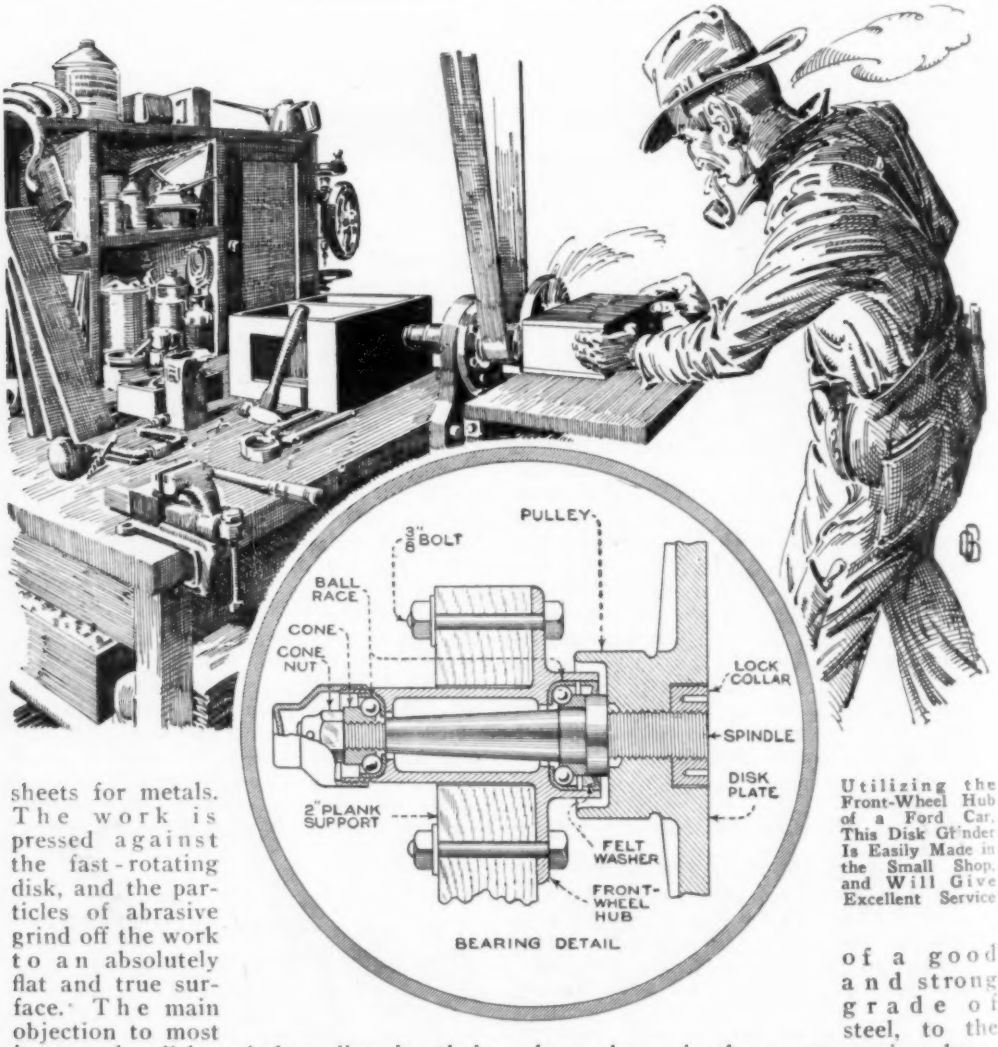
A Ball-Bearing Disk Grinder

By J. V. ROMIG

ONE of the most useful machine tools for the small workshop is a good substantial disk grinder. On it the workman can do many jobs in a minimum of time and with little labor, and also have the benefit of an accurate and finished appearance on the work.

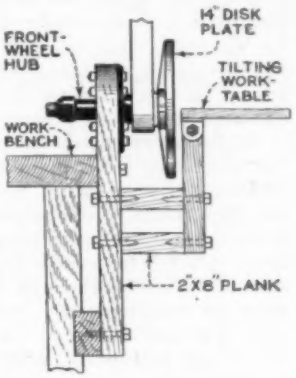
The disk grinder, as almost everyone knows, is a cast-iron disk or plate, mounted on an arbor or spindle, which has its working face covered with an abrasive sheet, using garnet or sandpaper for wood finishing and emery or carborundum sheets for metals. The work is pressed against the fast-rotating disk, and the particles of abrasive grind off the work to an absolutely flat and true surface. The main objection to most homemade disk grinders lies in their makeshift construction. For perfect work, a disk grinder must have good bearings, without any play or end movement. While solid bearings will operate for a time at least, the ball bearing is the ideal type to use.

In order to secure the benefit of a good ball-bearing installation in this case, without going to great expense, use is made of the front-wheel hub assembly of a Ford car. This can be purchased complete with balls and races for a few dollars, and the ball races, being of the cup-and-cone type, carry thrust loads as well as radial ones. In place of the regulation front-wheel spindle, a new shaft is turned out of a good and strong grade of steel, to the shape shown in the accompanying drawing, and hardened and ground. The bearing end is similar to the wheel spindle in all its threads, lengths and diameters, but



Utilizing the Front-Wheel Hub of a Ford Car, This Disk Grinder Is Easily Made in the Small Shop, and Will Give Excellent Service

is extended at the front end so as to carry the disk plate, as shown. This end is threaded up to the shoulder for the large front cone collar, and the disk plate is bored and threaded to fit. The disk is made of good gray iron, and is accurately threaded and turned, so that when screwed home on the spindle and rotated, it will run perfectly true and in balance. If out of balance, the plate will vibrate at high speed, and the builder is advised to find the heavy side, and chip the back of the plate until the plate balances in any position. The pulley is cast integral with the plate, as shown. In order to hold the plate tight on its threads, a recess is turned in it to take a collar. This collar locks the plate tightly, and should come just flush when screwed up tight with a pin spanner.



The mounting is simple in the extreme. A plank is screwed to the edge of the workbench, and a hole is bored through with an expansion bit large enough to allow the hub extension to pass through. Six ⅜-in. bolts hold the flange of the wheel hub firmly against this support. A worktable is made out of wood, as shown in the small drawing, and mounted on pivot brackets to allow it to be tilted at an angle for tapered or bevel work.

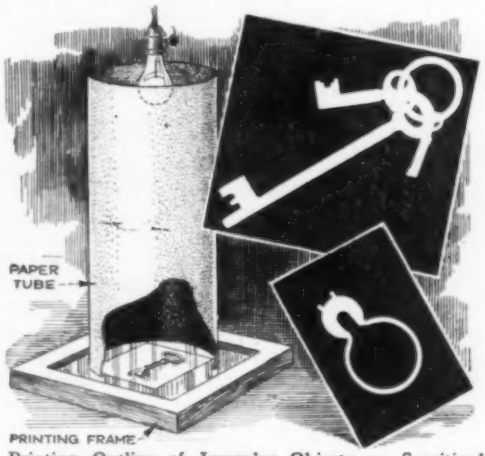
Even a ball bearing will wear in time, and this installation is the handiest possible for the purpose of adjustment. The hub cap is removed and the front cone is drawn up tight, so that the disk and spindle can be rotated freely without binding, after which the locknut is screwed home and the adjustment made permanent. The hub cap is also an automatic oiler in a way, as when it is filled with grease or vaseline and screwed into place, it drives the grease through the whole bearing and keeps the races perfectly lubricated. (Still better lubrication is assured by fitting an alemite coupling in a hole drilled and tapped into the hub shell behind the plank support, and using the gun to fill the shell, and to keep it filled.)

Disk grinders of this size should run at 2,000 r.p.m., which will give uniform results on both metals and wood. Abrasive sheets are listed in all catalogs of machinery-supply houses, and if the builder so desires, he can get quotations direct from any big abrasive house, who then will refer him to a local dealer. The sheets are easily applied, and give efficient service if used according to directions of the maker and distributor.

Measuring Irregular Objects

Accurate measurements of irregular objects can be made quickly and easily with the aid of photography. The illustration shows the method of doing this, and the inserts show some of the work.

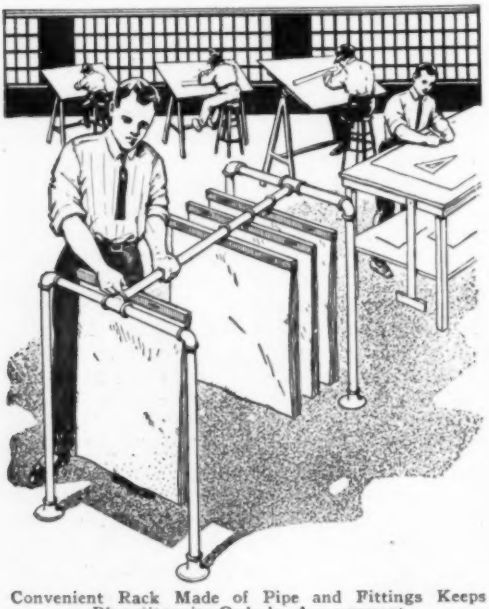
The sensitized paper is put in a printing frame and this is laid face up on a table. The object is then placed on the paper and a cardboard tube of suitable diameter to fit within the frame is set up as indicated. The printing is done by holding an electric lamp at the other end of the tube for about 30 seconds. Care must be taken to hold the lamp over the center of the tube so that the rays striking the paper will be nearly vertical. The inside of the tube should be painted dull black to prevent reflection. After exposure, the paper is developed in the usual way and an accurate outline of the object will show up on the prints. By this method gear-wheel teeth, keys, etc., can be measured much more quickly than by using a scale and calipers. When very accurate measurements are required, as is the case with small clock gears, etc., film should be used instead of paper and the resulting negative should then be enlarged.



Printing Outline of Irregular Objects on Sensitized Paper to Aid in Measuring Them

Rack for Blueprints

In shops and drafting rooms, blueprints can be handled conveniently by binding them together and keeping them on a rack of the kind shown in the drawing. Each



Convenient Rack Made of Pipe and Fittings Keeps Blueprints in Orderly Arrangement

set of blueprints is bound together at one side by means of two slats, through which three stove bolts are inserted. A galvanized-iron hook is provided in the center to enable the holder to be hung up on the rack. The rack is made of lengths of 1-in. pipe and fittings; the legs are provided with floor flanges, which are screwed to the floor. The construction is clearly shown in the drawing. — G. A. Luers, Washington, D. C.

Reducing Open-Fireplace Hazards

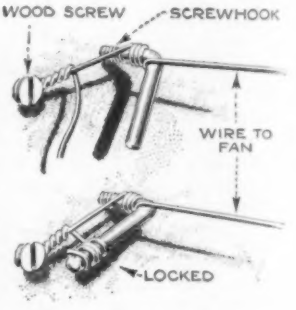
No single fire hazard affects the home and family more closely than defective chimneys, flues and fireplaces. People do not intentionally live in dwellings harboring a constant hazard of this kind, yet hundreds of thousands of these are in existence now, and new ones are being built every day. They are common in all types of construction. No so-called "fireproof" or "permanent" exterior walls will prevent interior fires where it is impossible to dispense with inflammable objects. Defective chimneys and fireplaces hold second place in the list of known causes of fire in order of importance.

To insure satisfactory results from an open fireplace, it is essential that the flue have the proper area; that the throat be correctly proportioned and located; that a properly constructed smoke shelf and chamber be provided; that the chimney be carried high enough to avoid interference, and that the shape of the fireplace be such as to direct a maximum amount of radiated heat into the room.

A fireplace properly constructed will carry all the smoke up the chimney and radiate the maximum amount of heat into the room. Woodwork for mantels, shelves or lumber framing should be carefully placed to avoid fire hazards. Several details which will minimize danger may be inexpensively included in the design for any house. To secure best results the following proportions are recommended: For fireplaces up to 48 in. wide, a height of 32 in. and a depth of 22 in. are ample. The sides should be splayed in about 3 in. on each side. Starting about 8 in. from the hearth, the back should slope forward under the rear flange of the damper. The higher the opening, the greater the chance of a smoky fireplace.

Tightening Guy Wires in Fan

Guy wires on a suspended overhead fan were tightened in a novel way as shown in the illustration. Two screws were used for each wire, one a flat-head screw and the other a screwhook. The former is driven into the wall nearly home, and the latter driven in to the right of it at a distance slightly greater than the length of the hook. The wire to the fan is twisted around the flat-head screw, leaving a short end, then passed over and around the screwhook, as shown. It is not necessary to pull the wire tight when doing this as it is evident that, when the screwhook is turned to the right it will coil the wire once at each revolution and so tighten it to any desired degree. For the final tightening, the handle of the screwhook is brought in alinement with the wire running to the flat-head screw, and the loose end of the wire is twisted around the screwhook to lock it.



RADIO

Makes Portable Radio from Camera

MR. W. O. Runcie of Philadelphia was once a camera enthusiast, so what more natural, when he fell for the spell of radio, than that he should build a set that would remind him of his former inseparable companion—his camera? He took a common pocket camera, removed the "works," and proceeded to build his radio set in it; the resulting receiver really is an excellent job, easy to carry and exceptionally neat and compact. The set itself is a two-tube reflex hookup, with a stage of radio-frequency amplification, a crystal detector, and two stages of audio-frequency amplification. The two tubes, which are of the UV-199 type, occupy the space formerly taken by the film spools; the knob of the control rheostat takes the place of the film-winding key, and the controls for the two book-type condensers are fitted to the removable back of the case. In a plate in one edge of the camera case are mounted a number of cord-tip jacks for the headphone and battery connections, the batteries being contained in a separate box not much larger than the camera. As may be judged from the photos, it took some planning to get the various instruments neatly arranged, but it must be confessed that the job was done in a very workmanlike manner. In building a radio set of this kind, it is necessary to use a camera case of not less than postcard size, in order to accommodate the transformers, etc.; an old stereo-camera case would be still better. The condensers should be of the book type, as compact as possible, and the transformers should be selected with regard to size and shape, so as to be as economical of space as possible. It will also be noted that the rheostat knob is smaller than usual. Then, by careful execution, there is no reason why the amateur should not be able to build as neat a set as that shown.

Above, Mr. Runcie with His Portable Reflex Set; Below, View of the Interior and the Removable Back with the Control Condensers

Giant Radio Set Needs No Aerial or Ground

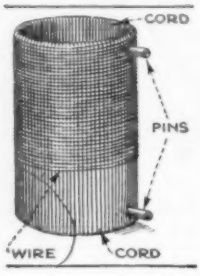
A "whale" of a set is that owned by Mr. F. R. Greene of New York City. One of

A Giant Set, Using a Combination of Either Eight, Nine, Eleven or Fourteen Tubes

the most complete and effective receiving stations ever built, it is a super-heterodyne unit employing either eight, nine, eleven or fourteen tubes. At least eight tubes, super-heterodyned, are used, in combination with either one, two, three or six stages of amplification. The B-battery supplies current at 275 volts, and two A-batteries are used, one of 6 volts at 150 amperes, the other 6 volts at 100 amperes. The set requires no ground or aerial.

Self-Supporting Inductance Coils

Ordinary single-layer inductance coils, which are self-supporting, are easily constructed if the following method is used: First obtain a cardboard tube, or other suitable form, which is slightly smaller than the desired diameter of the coil. Then wind ordinary cord around and through the tube, lengthwise, spacing it rather closely as shown in the illustration. After doing this wind on the desired amount of wire, spacing it closely and tightly, over the cord. When winding the coils insert pins of wood in the tube at both ends, and wind the wire around these. These form holes for mounting. Next give it a coat of good insulating cement, which has a low capacity effect (there are several good kinds on the market). When nearly dry cut the string

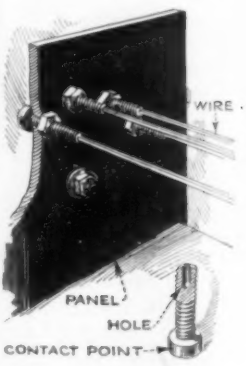


at the ends of the tube and carefully pull out the pieces, taking them out from all points of the circumference, until only four pieces are left, equally spaced on the surface of the tube. Withdraw the pins and the remaining pieces of cord and the coil may be slid off the tube. If this has been done very carefully the coil will be perfectly self-supporting. Next give the entire coil, both inside and out, several coats of the cement previously used. Stand on end till thoroughly dried out.

This completes the coil, and the holes at the ends serve to mount it in any manner desired by means of suitable screws and short lengths of brass rod. If made to the proper dimensions, it can be used for the primary of a variocoupler and also for inductance variometers, and will be found altogether reliable if constructed properly.—T. W. Heine, Baltimore, Md.

Soldering Wire to Contact Screws

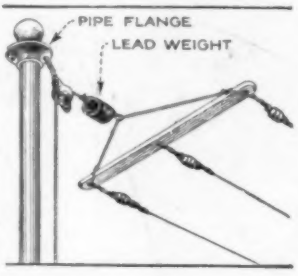
Most radio fans who "make their own" desire neat as well as properly soldered connections. The usual method of soldering wire to contact screws is to lay the wire on the threaded portion and then solder it. If considerable care is exercised in doing this, the job looks quite presentable, but it is usually rather difficult to get the wires just right, especially where there are a number of contact screws close together. Besides this, there is always the danger of damaging the panel with the hot soldering copper. The method shown in the illustration makes a neat job, and the extra work is offset by the freedom with which the wires and screws can be handled. A hole, large enough to receive the wire and about ⅛ in. deep, is drilled in the end of the screw. A little flux and a bit of solder are dropped into the hole and the screw heated with a soldering copper, or better still, with a blowtorch until the solder runs. Then the wire is inserted in the hole and after cooling, any surplus solder is wiped off. The resulting connection will be as neat as can be desired. The screws are inserted through the panel holes and the nuts screwed on to hold them. When drilling



the screws, they may be held in a vise, a piece of wood being used on each side to protect the threads. It is a good plan to have the nut screwed up to the head of the screw before soldering the wire, because some of the solder may get into the threads at the end, and this will make it difficult to screw the nut on, whereas the nut can always be unscrewed though a little more force is required. This method of soldering results in a much stronger connection than by using the old method.—Walter Chas. Michel, Jersey City, N. J.

Aerial Kinks

It is often quite a problem how to attach a pulley to the top of the aerial mast properly, especially if it is made of pipe. An excellent method of doing this is shown in the illustration. The end of the pipe is threaded and a floor flange with a hole drilled through it is screwed on; it is then an easy matter to attach the pulley to the flange.



Another trouble frequently experienced is that the bridle breaks where it is tied to the rope or the rope itself breaks near this point, and both aerial and rope then come down, making it necessary to "shin" the pole to thread the rope through the pulley again. To prevent this trouble a small piece of pipe or other metal weight should be tied to the end of the rope, as shown, so that the rope cannot slip through the pulley but can be lowered and then tied to the bridle again.—M. E. Duggan, Kenosha, Wis.

Size of Shields

When shielding is resorted to in order to eliminate interference from body capacity, etc., it is much better to use a small shield for each instrument than a large one covering the whole panel, as a loss of efficiency, due to intercapacity between the instruments, is likely to result in the latter case.—A. C. Cole, Chicago, Ill.

¶As early as 1909, Dr. Lee de Forest, broadcast Caruso's voice in "Cavalleria Rusticana."

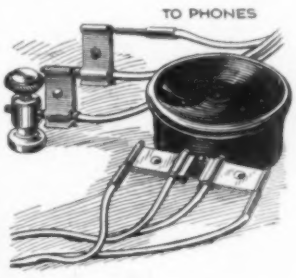
Girl Fan Builds Smallest Loop Aerial

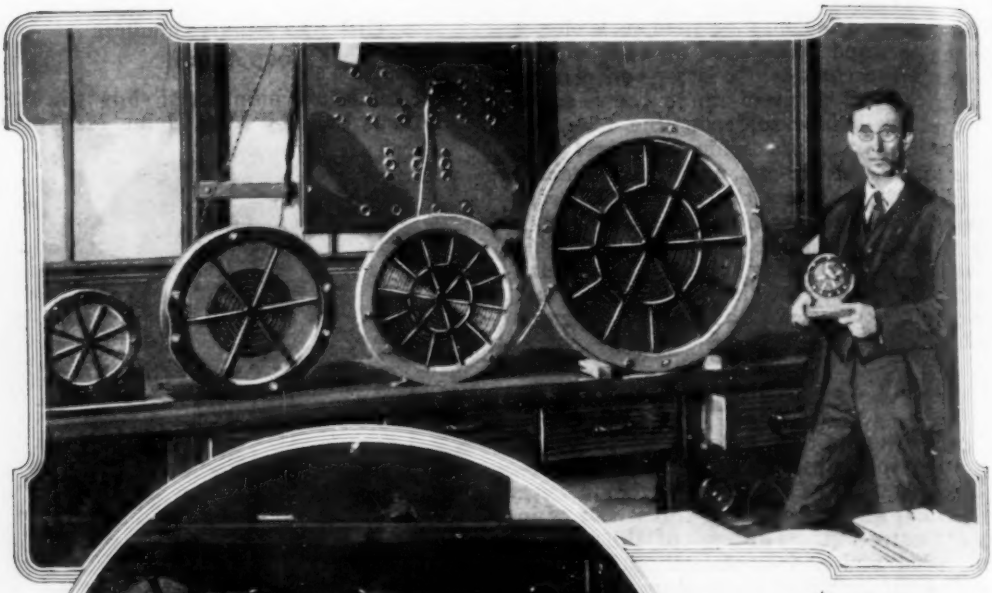
The miniature loop aerial shown in the photo was built by Miss Helen M. Obermiller, of New York, whose father is a noted radio engineer. It is called a variometer loop, as the inner winding of the antenna revolves. Although small in size, it contains an astonishing amount of wire, and Miss Obermiller uses it on her three-stage radio-frequency set with great success, bringing in Chicago and other distant stations loud and clear while using the loop alone.

This Miniature Loop Aerial Works Efficiently on a Three-Tube Set

Clips for Connecting Phones

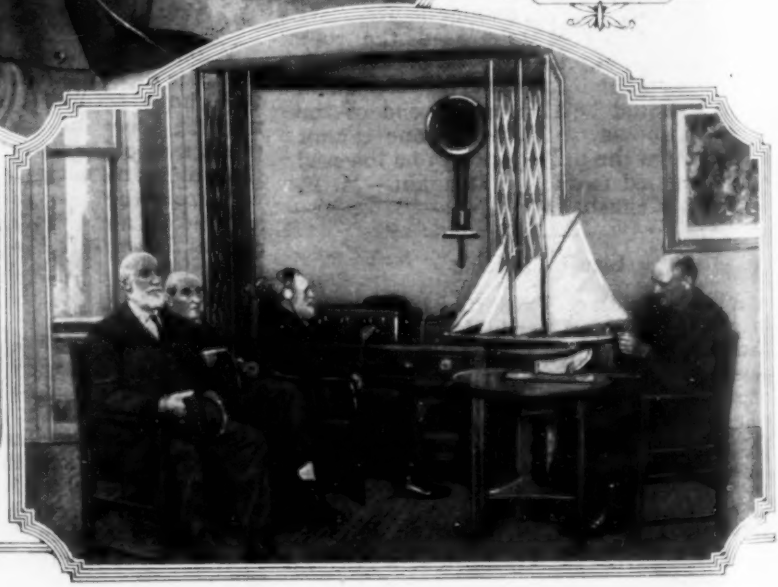
When it is desired to connect more than one pair of headphones to a receiving set, the phone terminals are generally connected by means of short pieces of wire from the junk box, if no regular fixture for this purpose is at hand. However, if one keeps on hand a few of the inexpensive clips shown in the illustration, which are now on the market, the phone terminals can be connected without the annoyance of having them come loose, as is commonly the case when they are tied together with wire. The clips are also useful for connections inside the set.





Loud Speaker That Employs Induction and Needs No Horn; It Is the Invention of Dr. C. W. Hewlett. Left, John Coolidge, with His Set, and the Lamp and Bible Used When the President Was Sworn In

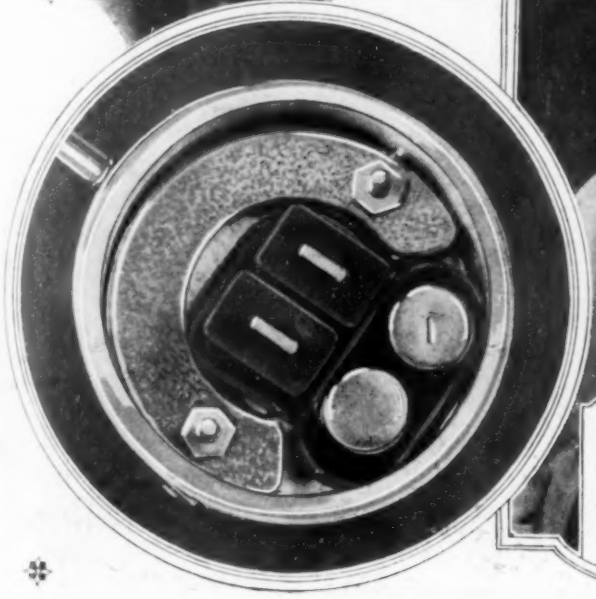
© Keystone



All the Old Seamen at Sailors' "Snug Harbor" on Staten Island Are Ardent Radio Fans; So Much So That the Harbor Set Is Inclosed in a Steel Cage to Prevent the Old Salts from Tinkering with It

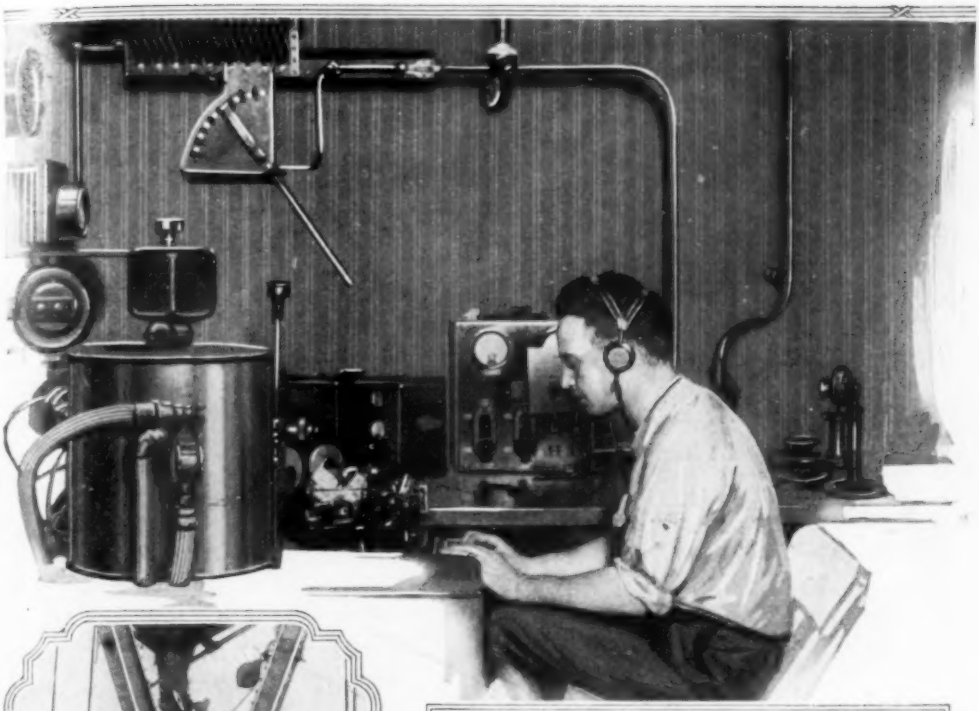
Great Loud Speaker That Announced the Results of the Olympic Games

An Enterprising Cincinnati Shoe-Repairing Shop Provides Radio Entertainment for Its Customers While Waiting for Their Shoes to Be Done



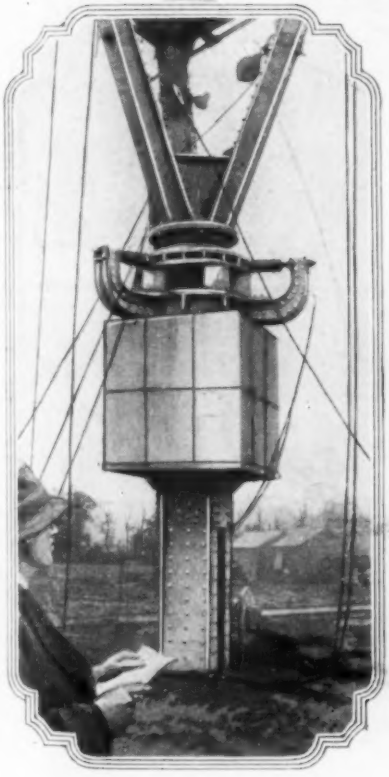
Frank Ferris of Boston, Wearing His Headphones, inside Which He Has Built a Crystal Detector. Two Crystals Are Used; This Will Reflex Any One-Tube Set

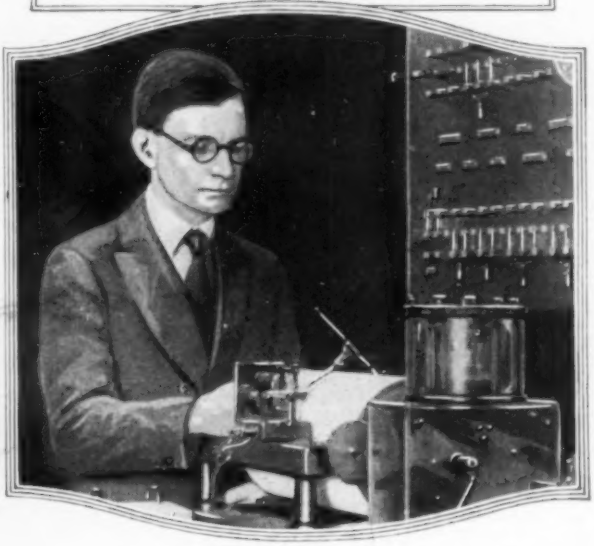
Above, a Class in a Swimming Pool Taking Advantage of the Swimming and Diving Lessons Broadcast from WEAF by Prof. Dalton; Below, Joseph Camarato, a New York Bootblack, Found Competition So Keen That He Built a Radio Set in His Box to Entertain His Customers



Chief Operator Dudley, of the Air-Mail Station KDQA, Which Will Aid in the Coast-to-Coast Air Service of the Post Office Department

© U. & U.





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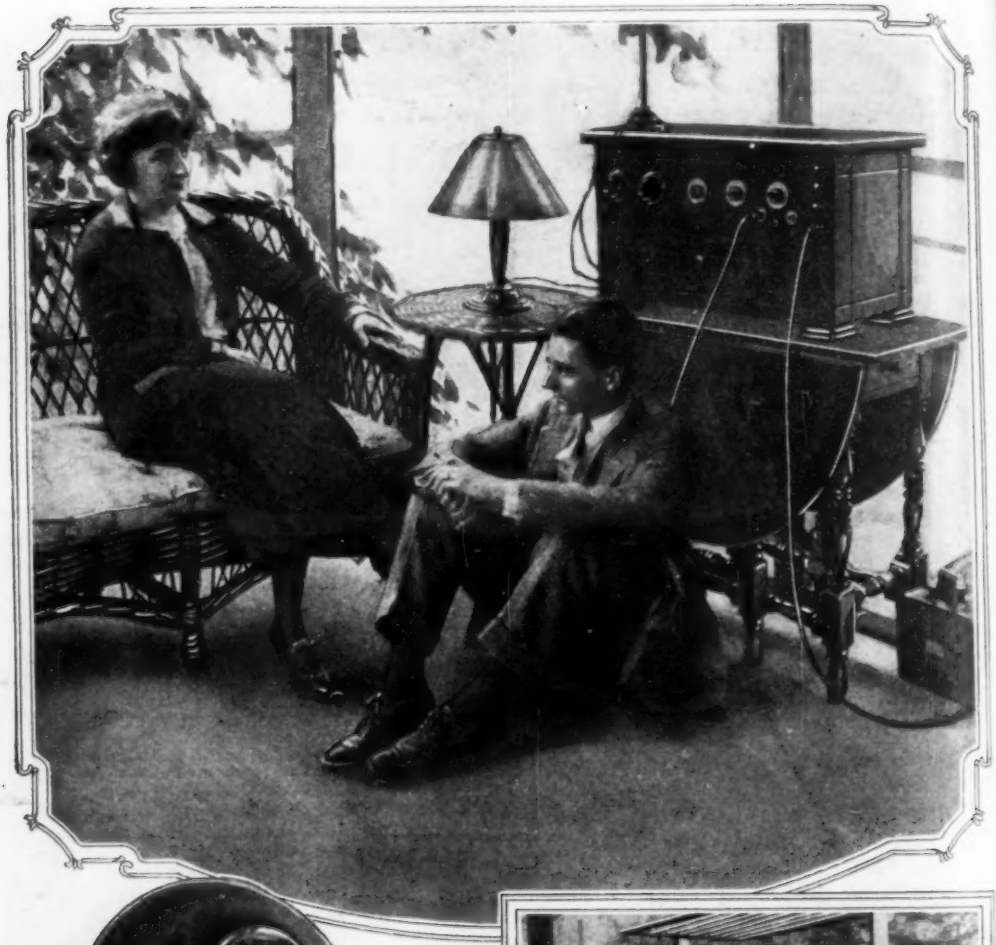
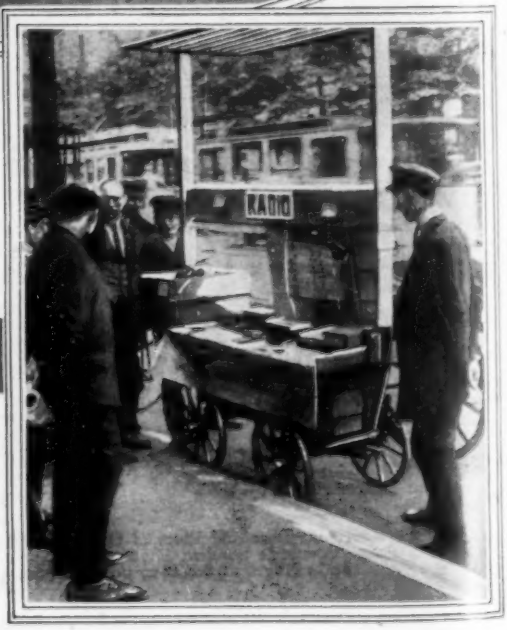
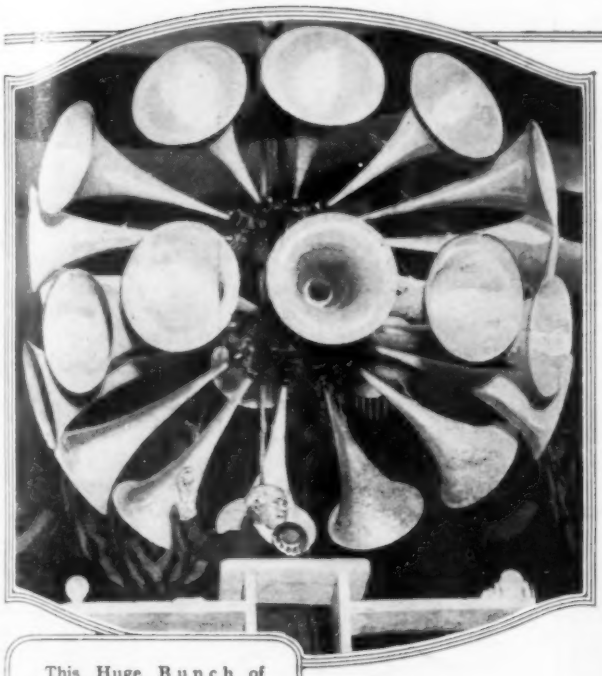
Left, the Enormous Base and Pivot of One of the Aerial Masts at Rugby, England, for the New York-London Radio-Telephone Service; Right, Paul Sollenberger, the Man Who Tells the United States When It Is Noon, at the Instruments in the U. S. Naval Observatory, Washington



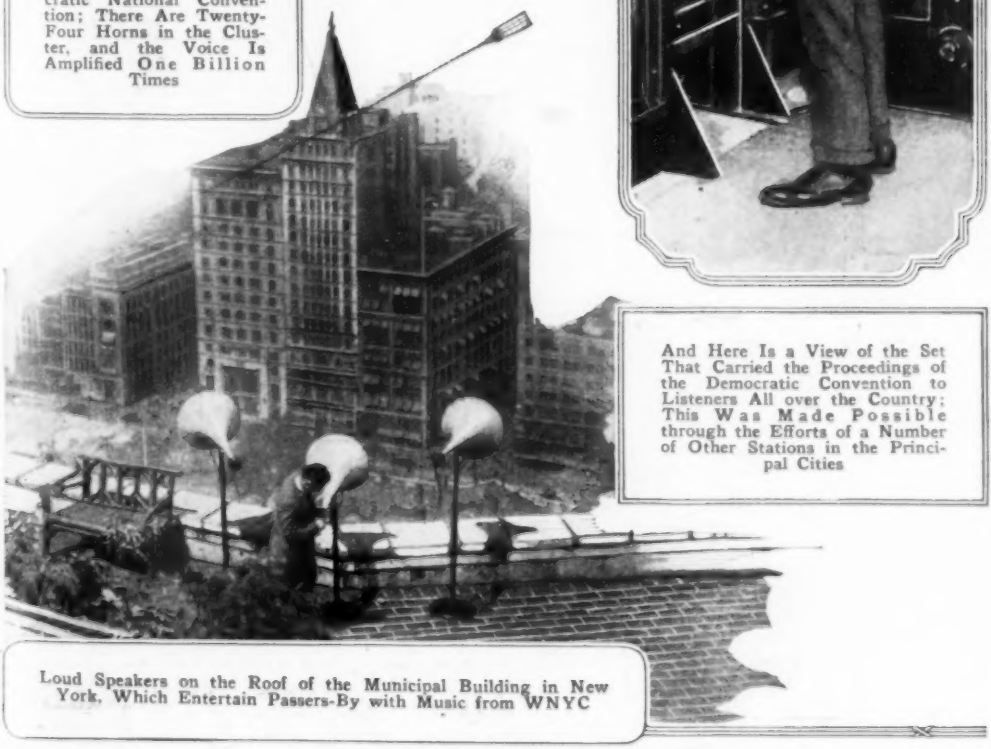


Above, the Latest in Loud Speakers Combined with a Table Lamp; There Is Nothing about the Lamp to Indicate Its Dual Purpose, and It Solves a Problem for Those Who Dislike the Appearance of the Ordinary Loud Speaker; an Inside View Is Shown at the Left. Right, in Germany the Street Peddler Vending Radio Parts Is Already an Institution

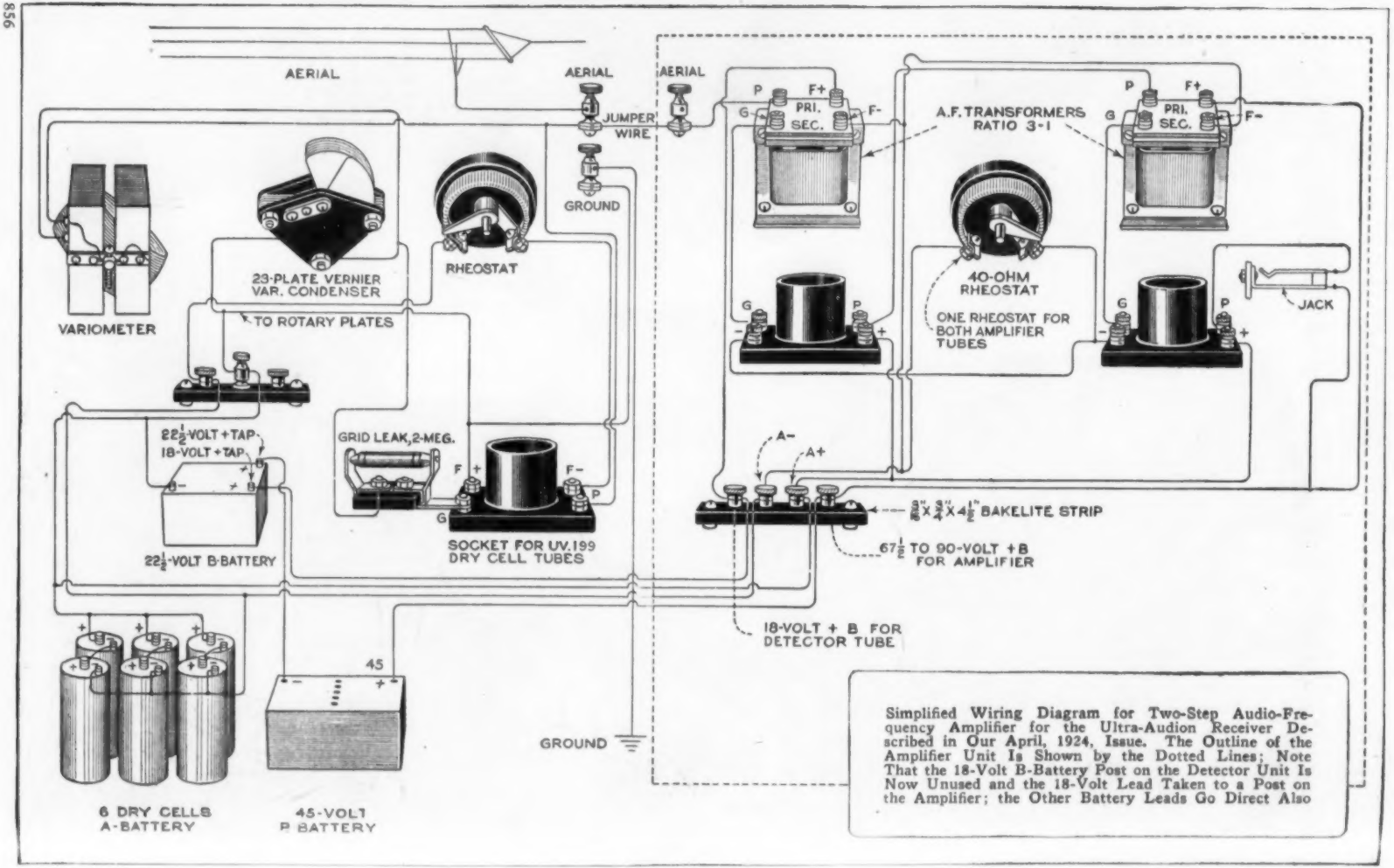


This Huge Bunch of What Looks like Easter Lilies Is the Mammoth Amplifier That Was Used in Madison Square Garden during the Democratic National Convention; There Are Twenty-Four Horns in the Cluster, and the Voice Is Amplified One Billion Times

And Here Is a View of the Set That Carried the Proceedings of the Democratic Convention to Listeners All over the Country; This Was Made Possible through the Efforts of a Number of Other Stations in the Principal Cities



Loud Speakers on the Roof of the Municipal Building in New York, Which Entertain Passers-By with Music from WNYC



Simplified Wiring Diagram for Two-Step Audio-Frequency Amplifier for the Ultra-Audion Receiver Described in Our April, 1924, Issue. The Outline of the Amplifier Unit Is Shown by the Dotted Lines; Note That the 18-Volt B-Battery Post on the Detector Unit Is Now Unused and the 18-Volt Lead Taken to a Post on the Amplifier; the Other Battery Leads Go Direct Also

Amplifier for Ultra-Audion Receiver

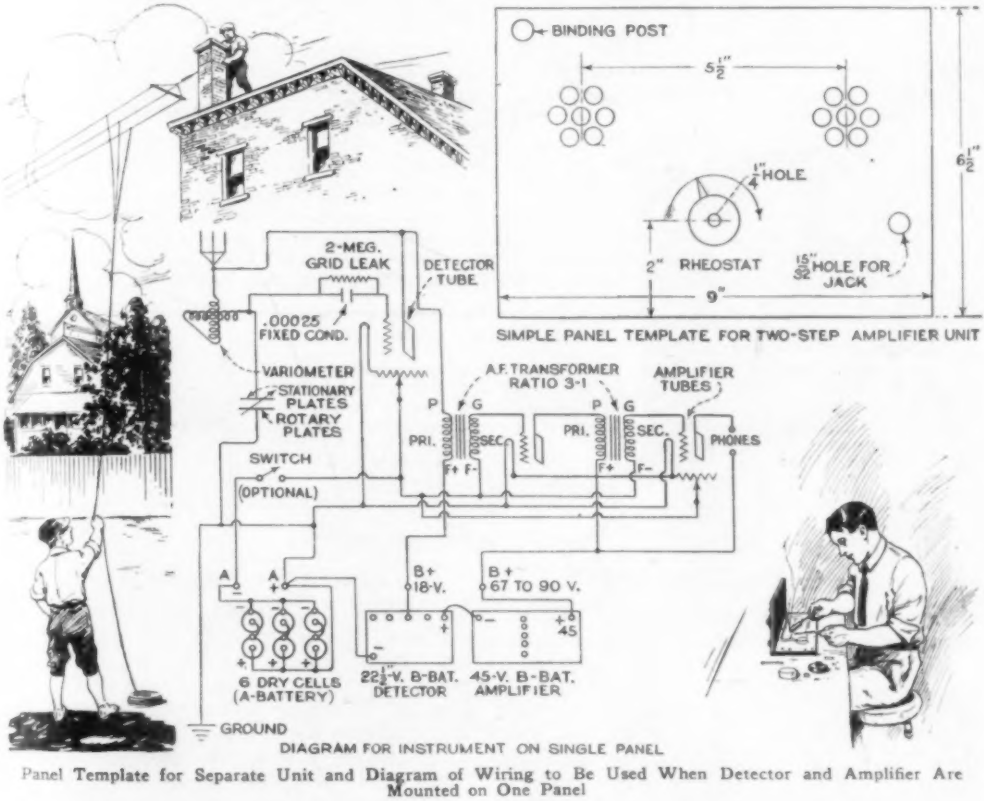
By F. L. BRITTIN

THIS article is printed in response to the demand for a two-step amplifier for the simple ultra-audion receiver described in our April issue, a set that has proved a universal favorite.

The detector and amplifier can be mounted on a single panel, but for those who do not wish to do this, the full-page diagram shows how the amplifier is connected to the detector already built, the outline of the amplifier unit being shown by the dotted lines. In this case the amplifier panel is 3/16 by 6½ by 9 in., and the baseboard ⅜ by 6 by 8½ in. The binding post in the upper left-hand corner is for the continuation of the detector plate lead, and is connected to the aerial post on the detector unit by a jumper. To simplify the wiring, the A and B-battery leads are connected to terminals mounted on a bakelite strip on the baseboard. The lead from the 18-volt B-battery tap now goes to a terminal on the amplifier strip, and thence to the positive-filament post on the first transformer. The 18-volt post on the detector unit is not used.

For those who prefer to build the set on one panel, a template drawing and wiring diagram is given. Those who wish to do so may employ a two-way jack in the detector circuit instead of the single-circuit jack shown in the diagrams, but the wiring for the latter is simpler, and the arrangement just as satisfactory.

Now that two more tubes are added, it is necessary to employ six dry cells as the A-battery, connected as shown in the diagram, to keep the voltage correct for the UV-199 or C-299 tubes employed, while increasing the amperage. A 45-volt B-battery is added also, connected in series with the detector B-battery from the 22½-volt tap. More B-battery voltage can be used if desired, but not to exceed



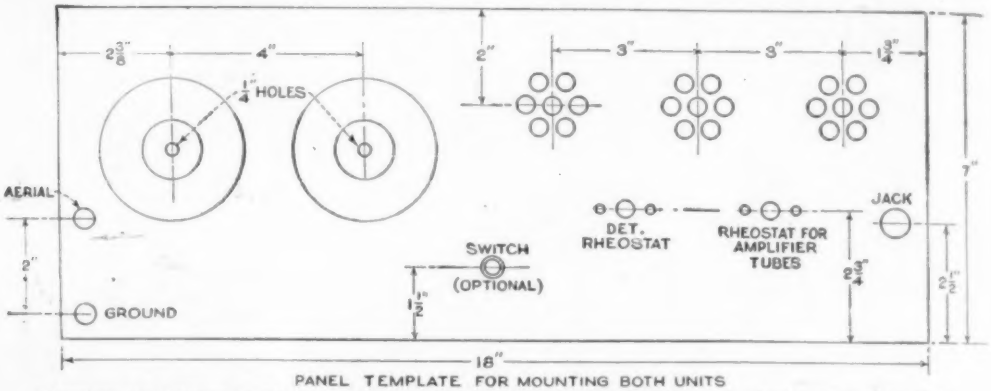
Panel Template for Separate Unit and Diagram of Wiring to Be Used When Detector and Amplifier Are Mounted on One Panel

90 volts on the plates of the amplifier tubes.

The 40-ohm rheostat in the amplifier circuit controls both tubes, eliminating one rheostat and simplifying the wiring, besides being more efficient than two.

This set can be operated with standard 6-volt tubes without any change other than the replacing of the dry cells with a 6-volt storage battery. With these tubes, however, control will be better if a 6-ohm rheostat is used in the detector unit and a 25-ohm rheostat in the amplifier. A UV-200 or C-300 tube should be used for the detector, and UV-201A or C-301A tubes for the amplifier. The filament switch shown may be used or not, just as desired.

The instructions as to care in wiring, soldering, etc., given for instruments previously described apply to this one also. When such care is used in assembly this will prove to be a very fine set.



PANEL TEMPLATE FOR MOUNTING BOTH UNITS

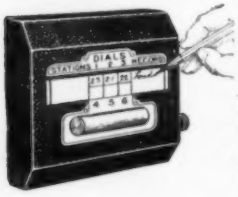
Template for Drilling Panel for Instruments When Detector and Amplifier Are Combined in One Unit

MATERIAL LIST

1 bakelite panel, 3-16 by 7 by 18 in., or
1 bakelite panel, 3-16 by 6½ by 9 in.
1 bakelite strip, 3-16 by ¾ by 4½ in.
1 baseboard, ⅜ by 6 by 17½ in., or
1 baseboard, ⅜ by 6 by 8½ in.
1 40-ohm rheostat.
2 UV-199 or C-299 tubes.
2 tube sockets.
6 binding posts.
1 filament switch (optional).
2 audio-frequency transformers, ratio 3 to 1 or 4 to 1.
Soldering lugs.
Wire.

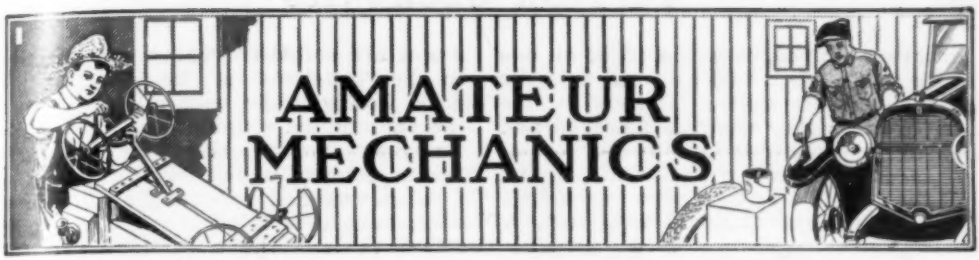
Logging Radio Stations

Neatness and compactness are the outstanding features of a new device for logging radio stations. The call letters and other data concerning the various stations are printed on a strip of paper, which is held on two rolls and turned forward or backward by means of two small knobs. When a station is received as loudly and distinctly as possible, one of the knobs is turned until the call letters of that station are found, and the dial readings are jotted down so that the same station can be tuned in later without delay. There is plenty of blank space on the paper so that call letters, etc., of new broadcasting stations can be added.



Passing the Plate by Radio

Pessimists say radio broadcasting can not continue indefinitely because there is no way to collect the cost from the ultimate consumer—the listener-in. The Sunday Evening Club, of Chicago, has disproved the assertion by successfully passing the plate to the radio fans when the weekly religious services of the club are broadcast each Sunday night from October to May. The club has never asked the radio enthusiasts to contribute, but each week gets a flood of letters containing donations. "I heard the plate being passed, and here is my donation," is a typical letter. The contributions range from a few cents to as high as $25, and the appreciation of the audiences was proved by the fact that the total amount of their gifts during the eight months of the 1923-24 season was between $1,200 and $1,300.



A Homemade Washing Machine

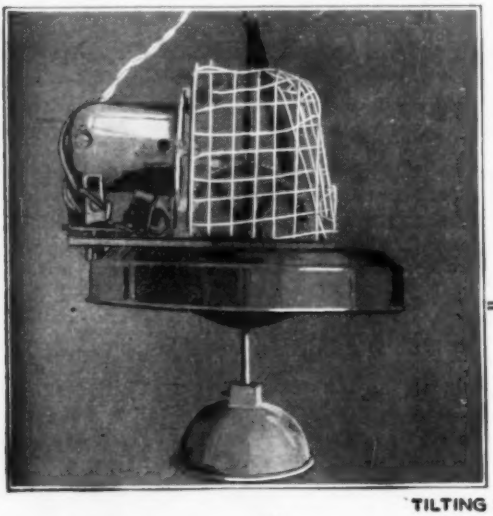
By D. O. WOODBURY

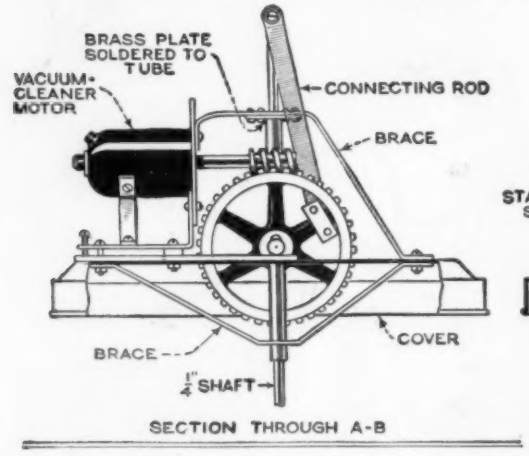
THE domestic handy man will, if he is ambitious, sooner or later try to build a washing machine. The accompanying illustrations show a home-built machine the first cost of which—about $10—was saved in a few weeks. There is nothing very difficult about this job, and, while it may be impossible to duplicate the design exactly, due to differences in the materials and motor employed, the same general idea may be followed.

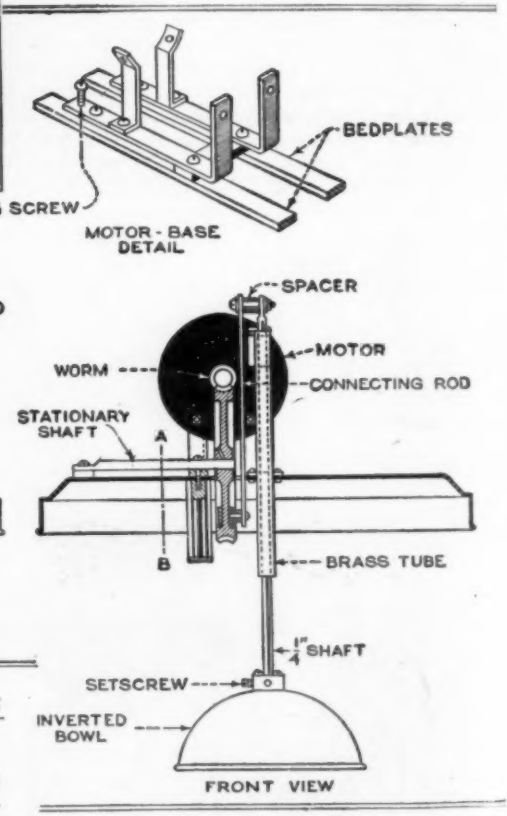
A small galvanized garbage can was first obtained, together with a secondhand vacuum-cleaner motor, an 80-tooth, 5-in. diameter worm gear and worm to fit, and an aluminum bowl of 6-in. diameter. The worm gear was fitted on the end of a ⅜-in. brass rod to run freely, and an oil hole drilled down at an angle through the hub. The gear may be held between two thin

Here Is a Small Washing Machine Easily within the Ability of the Amateur Mechanic to Build, and That Will Wash Articles Up to Bath-Towel Size

collars on the rod, or a thin collar on one side and a washer held by a screw in the rod end on the other. The end of the rod, or stationary shaft, is flattened and held to the cover of the can by a bolt passing through a spacing washer at the flattened end, and a screw driven into a hole tapped in the end of the vertical member







Details of Construction of the Homemade Washing Machine; Insert, View of Top of Can with Mechanism Attached

or strut of the lower brace, as shown in the front view. This strut is made of ½-in. round rod, and the remainder of the brace of flat stock.

The gear passes through a slot in the cover. The worm is fitted tightly to the motor shaft, and the motor fastened to the cover by means of the motor base or cradle, which is made of ⅛ by ½-in. flat stock. The strips that are screwed to the motor are bolted through a spacing strip to the "bedplates" at the front; at the back, however, the strip is omitted, and the ends of the strips drilled and tapped for screws that tilt the motor to permit fine adjustment of the worm and gear.

A brass tube, in which a ¼-in. brass rod slides snugly, is fitted securely in a hole drilled through the center of the cover. To the bottom of the rod the aluminum bowl is fitted, and the top is flattened and pivoted by means of a bolt and spacer to a ⅛ by ½-in. connecting rod; the other end of the latter is connected to the worm gear by means of a clamp and pin.

The motor is braced at the top as shown in the sectional drawing, and the cover is strengthened by means of flat strips screwed to the underside. A housing (not shown) is soldered around the bottom of the gear to prevent water from splashing through the slot in the cover, and a wire-netting guard fastened over the worm and gear. The motor, which is ⅛₈ hp., was too powerful for the work, so a 60-ohm resistance was connected in series with it.

This machine will produce snow-white

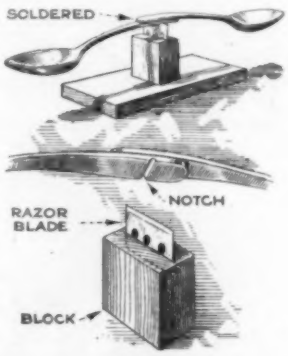
wash in five minutes when used with good soap. It handles pieces up to bath-towel size, and will pay in a few weeks for the time and money spent in its construction. Exact measurements cannot, of course, be given, as these will depend almost entirely on the size and design of the motor and the size of the can, but, with these directions, any amateur mechanic can easily adapt the motor he may have or can procure to the job.

Hinged Lens Cap

Many cameras of the more expensive kind are equipped with a lens cap, but the majority of photographers do not like the trouble of using one, and rather allow the lenses to become fogged and dusty. Besides, such a cap is easily lost or mislaid as it is not attached to the camera. Losing it can, however, be prevented by hinging it to the camera as shown. The hinge is made of sheet brass riveted to the lens cap and screwed to the camera.

Small Scales Made from Spoons

Small scales for weighing minute quantities of material can readily be made from two tin teaspoons and a razor blade. The handles are straightened out and soldered together as shown in the drawing. The balancing point is found and a groove is filed at this point on the underside of one spoon handle, as indicated. A wooden base of suitable size is made to hold a double-edge razor blade, which serves as a fulcrum. The small block holding the blade should be about 2 in. high. Any slight overweight on one side can be remedied by pasting paper to the bottom of the lighter bowl.



Wheeling Invalid into Auto

Invalids unable to stand up need not forego the pleasures of auto riding. The

Invalid Wheeled into Automobile over Portable Folding Gangway

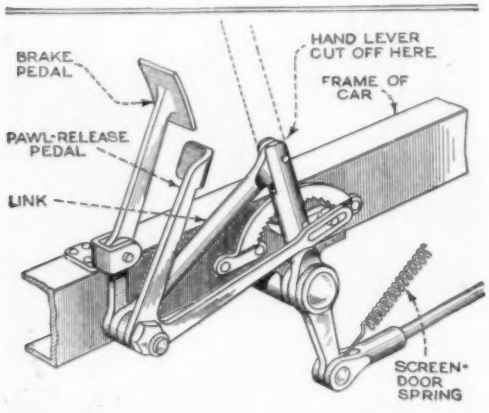
photo shows how to overcome the difficulty of getting them into the car. A two-door Ford sedan with a folding front seat allows space for the light wheel chair to be pushed inside, and the left arm of the chair is dropped down to slide the invalid off onto the seat. An inclined gangway is used to run the chair onto the car; this is provided with hooks that grip the door sill. The gangway and chair, which are both foldable, can conveniently be strapped on a luggage carrier at the back of the car.—Mrs. Louise M. Berry, San Diego, Calif.

Repairing Dents in Furniture

In refinishing a small cherry-wood table, which was an antique and a valued heirloom, many dents in the surfaces had to be removed. Most of the smaller ones disappeared after the surface had been smoothed down with glass and sandpaper but the deeper ones remained. These were then removed in a rather unusual way: A piece of coarse blotting paper was soaked in water and laid upon the dents and a very hot flatiron was set on the blotter. The shallower dents disappeared with one application and the deeper ones also became less noticeable after half a dozen applications. Where the wood had not been gouged out entirely, every dent finally disappeared, and after scraping, sandpapering, waxing and polishing, the beautiful grain of the table top was again brought out and its luster restored.—Truman R. Hart, Ashtabula, Ohio.

Changing Ford Clutch Lever to Foot Control

The clutch or hand-brake lever on the Ford is seldom used for emergency stops, as it is in a very awkward position to reach in a hurry. The average owner simply uses it to throw the clutch into neutral and to brake the car when at a standstill. By means of the simple attachment shown in the illustration, however, the hand lever is modified so that it can be applied with the foot without interfering with its clutch-releasing function. If the emergency-brake bands are removed after this is done, and bands substituted that can be faced with the brake lining used on other cars, a double braking system is made that is very effective in emergencies. The change from the ordinary brake shoes is not essential, of course, but, as these wear out quickly under constant use, it will be found better in the end to make the change suggested.



This Simple Attachment Replaces the Hand Lever on the Ford Car

The attachment consists of a pedal that actuates the rear brakes and releases the clutch at the same time. The hand-brake lever is cut off above the top of the pawl sector. A pedal is made of forged steel, to the shape shown, and pivoted on the frame forward of the brake lever. The top of the latter is slotted and drilled for a pin, and connected to the bottom of the pedal lever with a link. A forward movement of the foot throws the brake lever back, thus releasing the clutch and applying the brakes as before the change was effected. To release the pawl that holds the brake lever set, a small auxiliary pedal is necessary. This is made in the form of a bell-crank lever and pivoted on the pin at the bottom of the pedal lever. The back end of the lever is slotted to fit over a pin in the side of the pawl, and pressing the pedal forward throws the point of the pawl down and permits the brake lever to come forward. The auxiliary pedal is so shaped and mounted that it may be operated by the driver's heel. When the car is brought to a full stop, only the ball of the foot is used, and the pawl then locks the brake on. When using the brake to slow down the car in conjunction with the service brake, the whole foot is used, and the pressure keeps the pawl from engaging, so that the brake pedal returns to the same position when pressure is released.

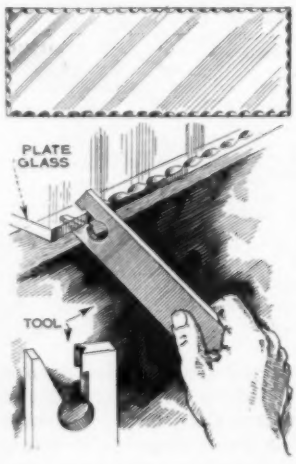
A screen-door spring should be fitted to the brake lever, as shown, so that it will be pulled forward as soon as the pawl is released.—G. A. Luers, Washington, D. C.

Keeping Hammer Head on Tight

A hammer head can be kept on the handle snugly and permanently by dipping the end of the handle in glycerin to thoroughly moisten the surfaces where the head touches. Also dip the wedge in glycerin and then drive it home. The glycerin absorbs moisture from the air and transfers it to the wood, which will swell out and grip the head securely.

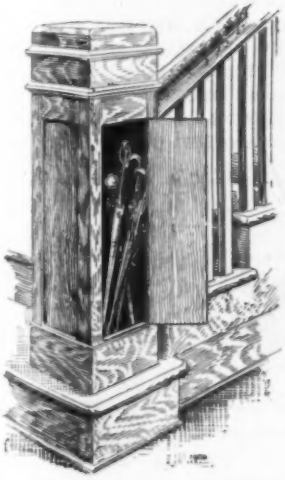
Plate-Glass Scalloping Tool

Few people understand how the edges of plate-glass signs are scalloped. The tool for doing this work is very simple and can be made in a half hour at the cost of a few cents. Although such a tool has been used by sign makers for more than 20 years, no special ability or experience is required to do this work. For ¼-in. plate glass, the tool is made from a piece of ordinary tool steel, 1½ in. wide, 10 in. long and $\frac{3}{32}$ in. thick. A ⅜-in. hole is drilled near one end and a slot of the shape shown is cut from this hole to the end. The slot is first cut with a hacksaw in straight lines, then the



file is used to form the upper hook and vee and to smooth the edges of the slot. When completed, the tool is tempered. In use the plate glass is placed on a flat surface and a piece of wood, fastened to the bench top with thumbscrews, is clamped down over the glass, which is allowed to project a little so that the tool can be applied to the edge as shown. It is given a quick downward jerk and a segment of glass will be snapped out, leaving a clean-cut, smooth surface. In this way the tool is used all along the edge of the glass. Before trying to do the work on a perfect piece of plate glass, it is best to practice on a broken or left-over piece until the "knack" of using and spacing the tool to form uniform scallops is acquired.—James E. Noble, Toronto, Can.

Making the Newel Post Useful



A handy place for storing umbrellas, where they are always ready when needed, is inside of the newel post of a front stairway. One panel is cut out, as shown, and hinged so that it serves as a door. A small snap latch with a knob should be provided to permit it to be opened and closed conveniently.—L. H. Georger, Buffalo, N. Y.

Close-Up Photos

By using an auxiliary lens, commonly known as portrait lens, close-up photos can be taken, as this lens shortens the focus. The same results can be obtained, in many cases, without such a lens if it is possible to pull out the bellows of the camera a little farther than the last mark on the scale. By doing this good pictures can often be taken at as close a range as three feet. If there is a stop on the focusing scale, this can often be filed off to permit extending the bellows without affecting the use of the scale for its purpose. —Duard E. Scott, Wellington, Tex.

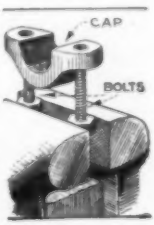
Attachment Enables Baby to Use Dining-Room Chair

A neat portable high chair, which may readily be stored away on the closet shelf,

Portable High Chair Made Almost Entirely of Pipe, Is Hooked on Back of Ordinary Chair

can be made by anyone without the use of any special tools. It is made almost entirely from lengths of pipe and fittings, with a small board used for a seat; ¼-in. pipe is strong enough for this purpose. Elbows and tees are used to connect the short lengths together, and holes are drilled through the board where the pipe passes through it. Holes for stove bolts are drilled through both seat and pipe to fasten the seat. A short length of rubber tubing is slipped over the upper ends of the pipe frame in order to prevent scratching the finish of the chair on which it is hung. The whole high chair is neatly painted or enameled in black, which adds considerably to its appearance.

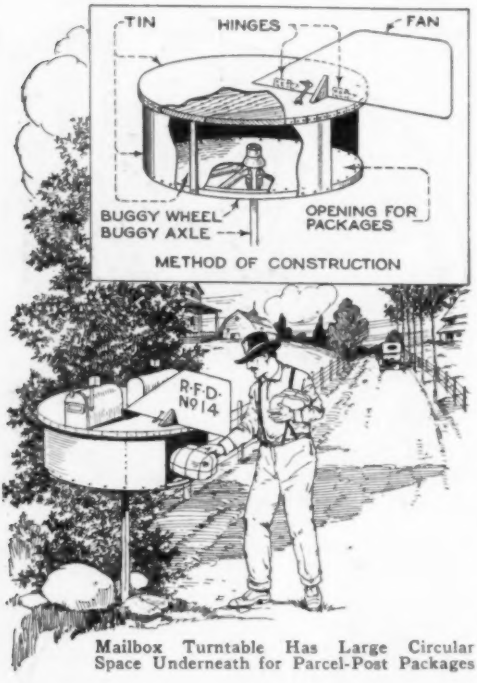
Holding Connecting-Rod Caps in Vise



Connecting-rod caps can be held in the vise securely by means of cap screws as shown in the illustration. The ends of the screws are placed in the holes in the cap and the heads are then pinched toward each other and clamped between the vise jaws. This holds the cap solidly enough for scraping.—Chas. Waldo Knight, South Windham, Me.

Mailbox Turntable Protects Packages

In rural districts where mailboxes are located along the roadside, sometimes a considerable distance from the farmers' homes, it is almost a necessity to provide a large box to hold parcel-post packages, as these would otherwise be exposed to the weather. Such a receptacle, in the form of a turntable on which one or more mailboxes are mounted, is shown in the illustration. It consists of an old buggy wheel and axle, the latter being driven into the ground securely. A circular box, about 18 in. deep, is built up on the wheel as shown. The top is made of ¾-in. lumber and is supported on uprights of the same material. The top, sides and bottom of the box are covered with galvanized iron. An opening about 2 ft. wide is left in the side and a vane is set up radially on the top, directly above the opening; this permits the wind to force the turntable around so that the opening is always sheltered.

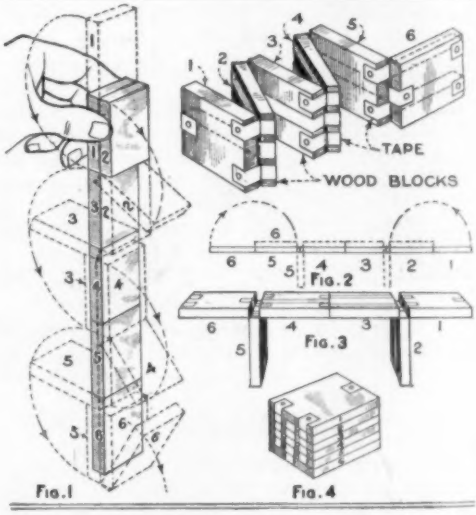


Mailbox Turntable Has Large Circular Space Underneath for Parcel-Post Packages

An Amusing Puzzle Toy

Children will find considerable amusement in operating the puzzle toy shown in the illustration, which is old enough to be new to the youngsters. It consists of a number of small blocks fastened together with narrow strips of tape, arranged so that one will appear to be tumbling over the others when the top one is turned over. The blocks are all of equal size, about 1½ in. by 2 in. in dimensions, being cut from material about ¼ in. thick. Not less than six blocks should be used to make the trick effective. The method of fastening the tape is clearly shown in the upper detail. When all are attached, the top block, marked No. 1, is grasped between the index finger and the thumb as indicated, its original position being shown by the dotted lines in Fig. 1, and it is brought down until its top edge strikes the lower edge of the second block, which will then fall over and strike the third block in the same way, and so on until the sixth has fallen over. The movement of the blocks is so rapid that it appears as if the second block moves all the way down to the bottom.

Fig. 2 shows another trick. Hold the first block in the right hand just as described above and the sixth block in the left, the blocks being stretched taut as indicated by the heavy lines in Fig. 2. While holding the blocks in a horizontal position these two blocks are turned over toward the center at the same time, and when they strike the blocks next to them the latter ones will drop down to the position shown in Fig. 3. Fig. 4 shows the blocks piled together.—H. H. Siegele, Emporia, Kans.



Simple Puzzle Toy Made of Small Blocks Is Amusing and Perplexing

¶Vinegar is the best substance for cleaning the mica panels of stove doors.

CONVERTING TOURING CAR INTO SEDAN

By RAY F. KUNS
PRINCIPAL, AUTOMOTIVE TRADE SCHOOL, CINCINNATI, OHIO

Part II

IT might appear that the doors are hard to make and hang. This is not necessarily true. While the methods given are not those used in production in factories, they do insure a good job. Commercial inclosed cars always have a rabbet of 1 in. on the lock side of the door. In this case, the rabbet is omitted because it is very difficult to cut without special machinery and also makes the fitting of the door harder. By providing some stop blocks, the absence of the rabbet will not be noticed. One and one-fourth to 1½-in. hardwood is used for the door-frame sides. Cut the pieces so that they will just fit into the doorway, and clamp one to each side of the doorways. These pieces will be 3 in. wide. With the sidepieces thus held in position, use a pencil to scribe a curve on them. Mark each piece to identify it for its proper position, since the pieces are not interchangeable.

Next cut the top and bottom as well as the center rails, and fit them into position, having first removed and cut the sidepieces to the curves marked. Again have these a snug fit in their respective places and mark according to your system of identification. Remove a set of the rails, and half-lap the corners and the center-rail joints. Do not cut the joints quite to a seat, since there may be—in fact, there is sure to be—a certain amount of wind or twist in each door which must be provided for in the fitting of the half-lap joints. With a little extra material to spare or cut on, the proper wind can be worked into the door.

Another kink in fitting the doors is to have all pieces originally cut to fit without clearance, but, when half-lapping, the joints on each end of each cross rail are cut 3/16 in. wide. This allows the side rails to come away from their companion posts by that amount, which is just the proper amount of clearance. Cut the side top-end laps 1/16 in. wide, which is sufficient clearance for the top, and allow 3/16 in. at the bottom.

With all parts of a door thus fitted, it is placed in position and rigidly secured with clamps so that it cannot move. Clamp 3/16-in. strips between the sidepieces and the posts. With the door held together in this position, the lapped joints are screwed together, and a stay strip is nailed inside the door frame. Leave the door frame in position while fitting the one next to it, so as to prevent springing the central post. If, as in this case, there are curves encountered, an iron brace will hold that corner of the door frame, as shown in one of the photos.

Hinging the door is the next job, and should be done before sawing off the long ends of the rails and sidepieces. Since the upper outside ends of the door sidepieces are square and plumb, the two top hinges are first fitted, and then the lower one is so arranged that the pin is in line with the two upper ones. Fit to the door first, and then place the door in position so that the vertical location of the hinges may be marked on the post. Hinges and locks may be obtained from the parts departments of many automobile agencies, or in the larger centers from dealers' or carriage builders' supply houses.

Now fit the sheet metal to the doors. If the body of the car is baked enamel, the panels for the doors may be enameled, and then fastened in place. In nailing,

use ¾-in. flat-head nails and fasten as close to the edge as possible. Have the metal turn in only at the top over the center rail. Obtain some T-rail molding from the supply house, and bind both sides and the bottom of the door with this. This insures a neat-appearing job, hiding all nail heads and stopping the 3/16-in. openings when the doors are closed. The steel used to cover doors and body is silver-finish auto-body stock.

The door-detail drawing shows the inside of the door with the molding strips (A) indicated that hold the window felt in place. This, too, is purchased from the dealer or supply house and must be on hand when planning the width of the groove to receive it. It is more satisfactory to purchase the lifters for the glass than it is to attempt to make them. A grooved strip of wood is glued or shellacked to the lower edge of the ¼-in. plate glass, for the roller of the lifter to rest under. If desired, straps may be attached to these strips for lifters, as was the usual practice some years ago.

If it is desired to paint the body, the sheet-metal covering for the rear must be applied in one piece, and the windows, side and rear, cut out, allowing 1 in. to turn in over each edge. If the job is to have a covering of pantasote or similar material, the sheet metal may be nailed on with the flat-head nails, and even joined on occasion over a piece of hardwood or on a post. In this case, bring the edge of the metal to the edge of the window opening. Very little trouble will be found with either the doors or rear of the top, since there are only simple curves encountered. All sheet metal tends to bulge or buckle just a little, and this fact may be used to advantage by springing the bulge out, and, if need be, adding to it just a little after the metal is nailed in place by driving from the inside with a rubber mallet. Great care must be used, however, in this operation.

When applying the covering to the rear part of the top, a waterproof glue is used, and the covering cut long enough to run all the way around the two rear side and back windows. Glue is applied to both body and pantasote, and then when the covering is applied, it is certain to hold. Cut out the windows, allowing 1 in. to turn in, and tack. Trim along the lower edge of the new metal and cover the joint with "hidem" welt, held in place with tacks, or short bolts in all-metal construction jobs.

The top covering is made in three pieces. Two seams, one on either quarter of the roof, will show, but this adds to rather than detracts from the appearance. When laying on the roof, start at the center of each end and work to the sides. Stretch the pantasote tight every inch of

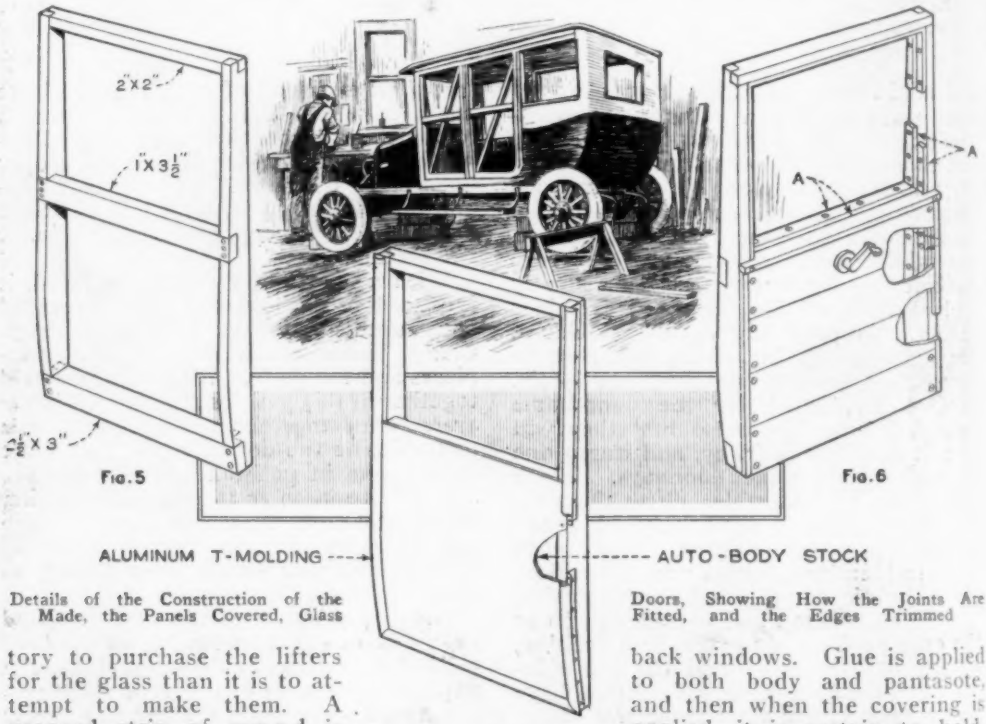
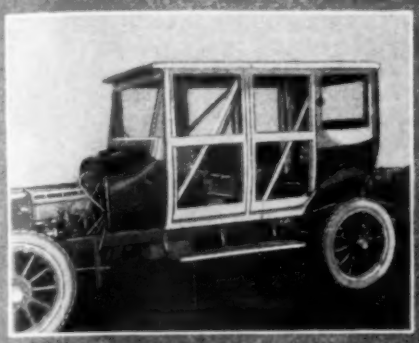
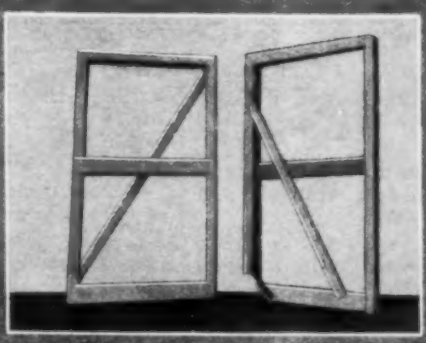


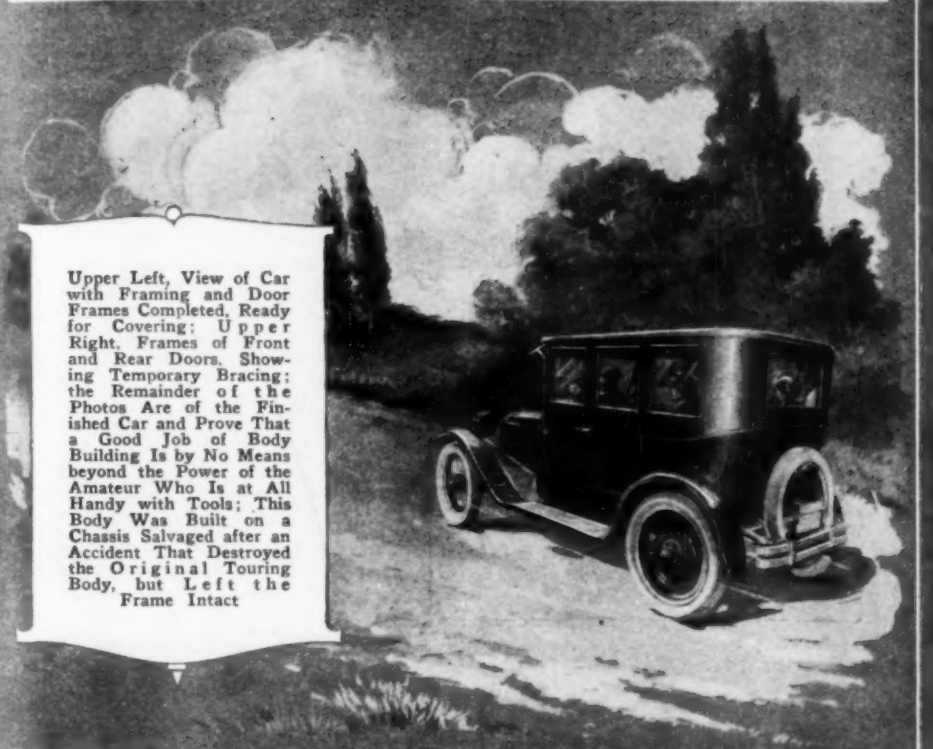
Fig. 5

Details of the Construction of the Doors, Showing How the Joints Are Made, the Panels Covered, Glass Fitted, and the Edges Trimmed

Fig. 6







Upper Left, View of Car with Framing and Door Frames Completed, Ready for Covering; Upper Right, Frames of Front and Rear Doors, Showing Temporary Bracing; the Remainder of the Photos Are of the Finished Car and Prove That a Good Job of Body Building Is by No Means beyond the Power of the Amateur Who Is at All Handy with Tools; This Body Was Built on a Chassis Salvaged after an Accident That Destroyed the Original Touring Body, but Left the Frame Intact

the way and, at the rear, it will be necessary to use extra force to pull out the wrinkles. Nail the top within ½ in. of the bottom of the plates. These tack heads are covered by the eave trough which is run on around the front and along the sides. The rear joint is covered with the welt.

The rear side windows and the rear window are finished with mahogany molding. Where possible, it is advisable to arrange the rear side windows to drop down to the wheel housing at least. Otherwise all three glass panes are set in some of the felt strips held between the mahogany strips.

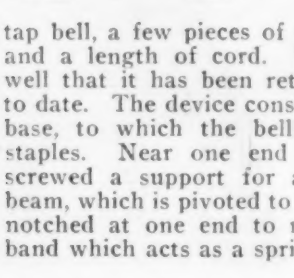
The whipcord lining and trimming for the inside are readily tacked in place, and all edges secured under the window moldings, or covered with gimp to match. The lower part of the doors (inside) is covered with pantasote. The front-seat shell is brought around and joined to the inside of the center posts. The springs are returned to the seat shells, and the upholstering is replaced. It is very likely that there will be more than enough of the material, in which case the surplus is easily cut away. After the leather is again in place, all raw edges are bound with new gimp. While velours and similar materials are much used in inclosed cars, leather is finding increasing favor. If the leather does not quite meet the approval of the critical family, the seats may be covered just as readily as the velour cushions, and the appearance is identical.

Painting on a job of this sort, if the job is enameled, is a very small item, since it means merely touching up the inside edges of doors, etc. If the body job is paint, it would be well to turn it over to the professional, though some amateurs can do creditable paint work. If all the paint of the old body is removed, and the body sanded smooth, one or two coats of fast-drying enamel will make a good-looking job.

The following dimensions or allowances will help the beginner in planning his work. They need not be taken as unalterable. They are given as a standard from which to work, and are the exact dimensions in use in one certain car of undoubted good design: Height over all, 77 in.; rear window, 32 by 16 in.; rear side windows, 17 by 22 in.; door-glass height, 17 in., width, 23 in.; door width, 28 in.; door height, 46 in.; door top to roof top, 4 in.; floor to seat-cushion top, 13½ in.; top of seat cushion to ceiling, 36 in.; width of body at windshield, 46 in.; wheelbase, this car, 136 in.; and ground to frame top, 25 inches.

A Mechanical Call Bell

My workshop is on the floor above the office, and when anyone arrived in the office while I was in the shop, it was necessary to have some means of announcing his presence. Having no electrical mechanism at hand, I was forced to use other material. I quickly rigged up the device shown in the drawing, using an ordinary desk tap bell, a few pieces of wood and metal and a length of cord. This worked so well that it has been retained in service to date. The device consists of a wooden base, to which the bell is fastened by staples. Near one end of the base is screwed a support for a small wooden beam, which is pivoted to the support, and notched at one end to receive a rubber band which acts as a spring. A screweye at the other end holds the end of the cord, which is led through other screweyes to the floor below. As the beam rests over the plunger of the bell, a pull on the cord causes the bell to ring.—Paul E. Garber, Washington, D. C.



Locking an Extension Table

To prevent the two ends of an extension table from pulling apart when not desired, an ordinary window catch can be fastened and locked in place to the underside of the table top, with one part on each end of the table. If only one catch is used and fastened in the center, it is best to mark it off first and then pull the table ends apart to fasten the catch more easily. For very heavy tables it may be necessary to use two catches. In such cases one is placed on each side of the center.

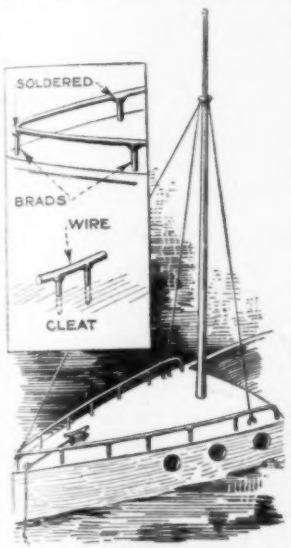
Cleaning a Typewriter

Irregularities in feeding the paper into a typewriter are often due to slippery spots on the platen. To overcome this trouble, clean the platen thoroughly with a mixture of two parts of denatured alco-

hol to one part of ether. Rub the polished parts with No. 2 emery cloth, then smooth the surface with No. 0 emery cloth. In cleaning a typewriter with gasoline, the effect is to leave the parts dry. A better method is to use a mixture of one part of typewriter oil to 50 parts of gasoline. This will leave a coating of oil, which is too fine to collect dust, on the working parts.

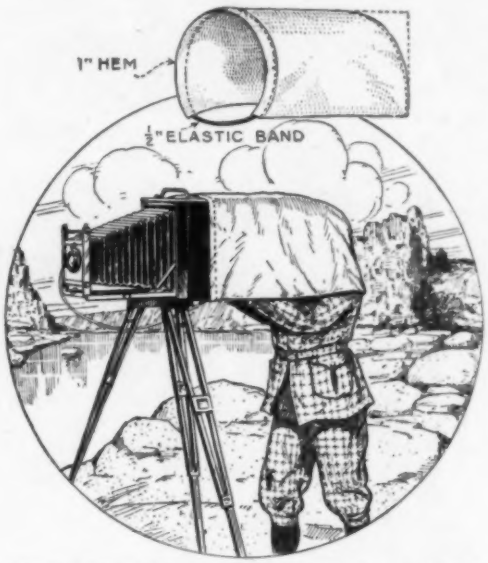
Soldered Fittings for Small Toy Boats

The appearance of small toy boats is greatly improved by providing a neat rail and cleats as shown in the illustration. These fittings are made from wire and brads; the square wire used in radio work looks especially neat for this purpose. It is bent to follow the curve of the hull at the deck and soldered to the heads of brads, driven partly into the wood a suitable distance apart. Careful soldering makes neat joints and a strong rail. Cleats are made by driving in two brads, not too closely together, and soldering across their tops a short length of wire which is bent up slightly at both ends. The wire and nails should be selected with due regard to the size of the toy.—William T. Miller, Roslindale, Mass.



Stationary Focusing Cloth

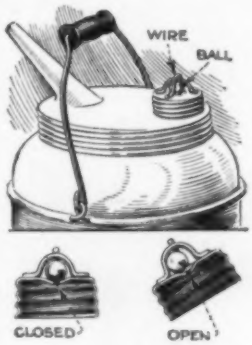
Every photographer whose work has progressed beyond the guessing stage knows how troublesome the use of a focusing cloth is on a windy day, as he can hardly hold the cloth around tightly to exclude the light and at the same time adjust the camera. This trouble may be eliminated by sewing a 1-in. hem on one side and providing an elastic band in the hem so that it can be snapped around the camera as shown. The other end is trimmed off and sewed so that only the bottom remains open; this can easily be held closed with one hand while the camera is adjusted with the other hand.—J. E. Hoag, Los Angeles, Calif.



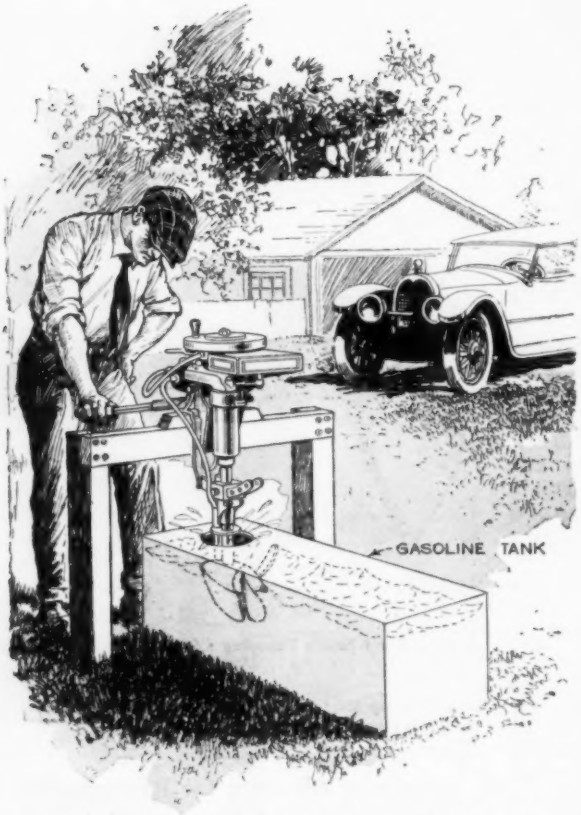
Elastic Band Holds Focusing Cloth in Place on Windy Days

Automatic Air Vent for Kerosene Can

When pouring oil from a can it is necessary to unscrew the cap to admit air, and this takes considerable time, besides involving the possibility of losing the cap or forgetting to replace it. A simple method of providing an air vent without removing the cap is shown in the illustration. A small hole is punched in the center of the cap, and the top is dented in around the hole to accommodate a small steel ball. Two short pieces of wire are bent to a semicircular shape and soldered to the top of the cap, as indicated, to keep the ball in place. In use, the tipping of the can causes the ball to roll out of its seat and allows air to enter through the hole.—Adolph Rieter, Marinette, Wis.



¶ Pure glycerin will remove coffee and tea stains on silks and woolens.



Convenient Testing Tank for Outboard Boat Motor Made from Old Gasoline Tank

Testing Tank for Outboard Motor

After repairing an outboard motor, it should be tested when the propeller is submerged in water so that the motor will pull a load. When the lake or stream in which the boat is kept is rather far distant, a testing tank can be made from an old automobile gasoline tank. A circular hole is cut in the top near one end, to allow the propeller to be inserted. A wooden rack to hold the motor is made by nailing a 2 by 4-in. crosspiece to the top of two posts driven into the ground. The motor is mounted on the rack with the propeller in the tank, which is filled with water. Running the motor will then show whether it is working properly.—J. E. Hoag, Los Angeles, Calif.

Removing Iodine Stains

A good way to remove iodine stains from the hands or linen is to wash the stains in a strong solution of hyposulphite of sodium, commonly known as hypo, which is procurable at any photographic supply house or drug store. The best results are obtained with a solution of 1 oz. of hypo and 2 oz. of water.

Simple Pail Handle

Most pails used on the farm for carrying feed, water and milk are equipped with plain wire bails. This makes it rather uncomfortable to carry them for any distance when filled. Handles can, however, be made from sheet metal, cut in pieces about 6 in. long to the shape shown in the illustration, and with holes punched and slots cut at the ends, large enough to receive the bail. The ends are bent upward along the dotted lines and the whole piece curved both ways, as shown, to form a comfortable handgrip. The edges are then filed smooth, and the handle is attached by opening the slots and pinching them around the bail as indicated.—G. E. Hendrickson, Argyle, Wis.

Blower for the Furnace

When the furnace is slow to start, due to poor fuel or insufficient draft, an effective blower which will boost the fire quickly can be improvised from an electric vacuum cleaner. The dirt-receiving bag is removed, and the vacuum cleaner placed in front of the draft opening of the furnace so that it forces a draft. Another place to put the vacuum cleaner is in front of the clean-out door of the chimney. In both cases the check door of the furnace must, of course, be kept closed. It will be found that either of the two methods will fan an apparently dead fire into a roaring blaze quickly.—H. E. Benson, Boulder, Colo.

¶Ventilation is a necessity for stored potatoes to keep them in good condition.

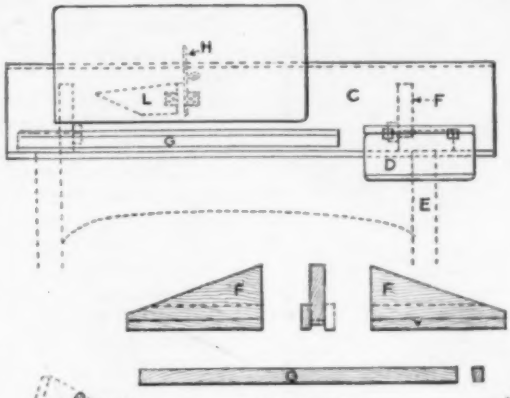
Desk Attachment for Morris Chair

By F. M. ARTHUR

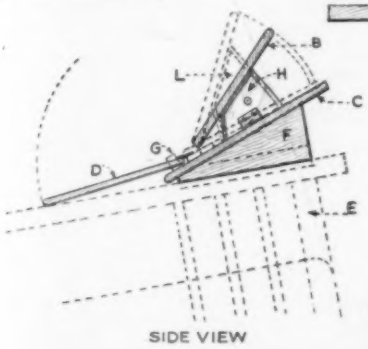
THE attachment shown in the accompanying illustrations forms a welcome addition to the morris chair, especially for the student, as he can make notes from a textbook while sitting in a comfortable position. The construction is simple, and there is no elaborate woodworking necessary.

The attachment consists of a wide board, C, resting on the arms of the chair, and fitted with a reading leaf, B, and a writing leaf, D. The board C, which in this case was made from a filing board with the clip removed, is provided with two triangular supports, F; these rest on the chair arms, and the board is prevented from moving sidewise by strips, screwed to the inner sides of F and bearing against the inner edges of the arms of the chair.

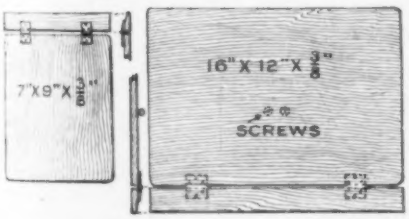
The reading leaf is 16 by 12 by ⅜ in. in dimensions, and is hinged to a strip of wood of the same length, which is screwed to the main board C. This strip is tapered on the top side so that, when the leaf is dropped, the top edge will come against the main board, as shown by the dotted lines in the side view. The leaf is fitted with two supports, H and L, made of heavy sheet metal; these are hinged to board C, and serve to adjust the leaf to two different heights. Two small round-head screws are driven into the center of the leaf, on the underside, and the

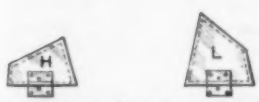


FRONT VIEW



SIDE VIEW

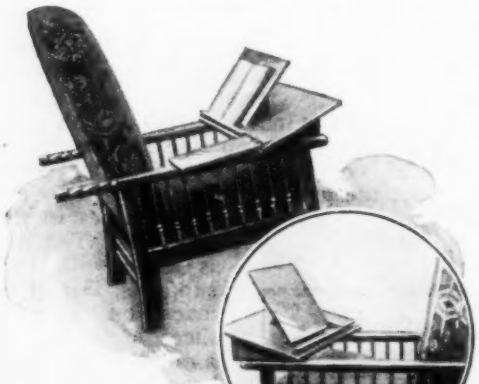




WRITING AND READING LEAVES AND SUPPORTS

An Easily Made Reading and Writing Attachment for the Morris Chair That Will Prove a Boon to the Student, or to Anyone Fond of Reading

supports, when raised, are held between these. When the reading leaf is in use, the book rests against strip G, which is screwed to the board below the leaf.



Above, Reading and Writing Leaves in Position for Use; Inset, Writing Leaf Folded Out of the Way

The writing leaf D, 7 by 9 by 3/7 in. in size, is also hinged to a small tapered strip, which is screwed to the board at the right-hand side. When in position for writing, it rests on the chair arm, and the latter forms a rest for the user's arm in writing. All pieces that come in contact with the chair are faced with thin felt to protect the arms, and the whole attachment is then stained and finished to match the woodwork of the chair.

Stopping Leaks in Radiators

Radiator leaks are hard to repair. Sometimes they may be fixed temporarily by putting ground flaxseed, corn meal or very fine sawdust in with the cooling water, but such methods inevitably lead to the permanent impairment of the radiator. The following method, however, if carefully followed, can be depended on in many cases:

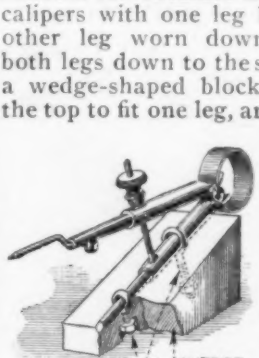
Remove the radiator from the car, and lay it, front down, on a pair of sawhorses. Put on the filler cap, and fill the radiator through one of the hose connections. Hold a droplight under the radiator and watch for the source of the drips, then mark the spots. If these are in the tubes, and not more than five tubes are affected, pinch the tubes top and bottom with a pair of thin-nosed pliers, thus cutting them off from the rest of the cooling system. If the leaks are in the top and bottom tanks, or in the headsheets where the tubes enter the tanks (a very frequent occurrence), be sure they are marked so that the places can be found later, then drain the radiator. Now, with a torch warm the radiator all over until it is certain that the water is all dried out, but be careful not to get it hot enough to melt the solder.

Through the hose connection nearest the leak pour two tablespoonfuls of common yellow sulphur. Place the radiator in such a position that the sulphur will fall around the leaks, then heat the radiator at these points to a temperature that will melt the sulphur, which has a melting point much lower than solder. Rock the radiator during this operation so that the melted sulphur will cover all the metal around the leaks, then allow the radiator to cool. If the sulphur has run down into the tubes and congealed there, heat the tubes until it runs out. It is possible to repair leaks in the tubes themselves in this manner. As soon as the sulphur melts, work as fast as possible, taking care at the same time not to set it on fire, as sulphur ignites very easily, is hard to extinguish and makes nasty burns.

Finally, make sure that the overflow drain or vent tube is not stopped up, as fully as many radiators are ruined through steam pressure bursting the joints as from vibration or freezing.—Carleton F. Worfolk, Royal Oak, Mich.

A Homemade Surface Gauge

An apprentice in a machine shop did not like the idea of buying a surface gauge, which he needed, but decided to make one himself. He obtained an old pair of spring calipers with one leg broken off and the other leg worn down. After grinding both legs down to the same length he made a wedge-shaped block with a groove in the top to fit one leg, and drilled and counterbored two small holes through the block for eyebolts, which were used to hold the leg on the block securely, as shown. He also drilled and tapped a small hole through the other leg for a thumbscrew, which was used to hold a scratch pin slipped in a slot cut lengthwise in the end. The resulting gauge gave just as good service as a regular one would have done.—Frank N. Coakley, Buffalo, New York.



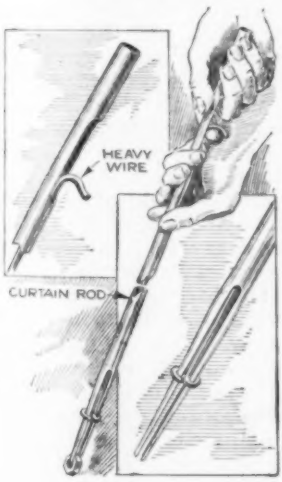
An Artistic Storm Door

There seems to be no happy medium between the expensive glassed-in porch and the ugly, drab storm doors used on the more modest houses. We could not afford the glass porch, but we could see no reason why we could not make the storm door as artistic as possible.

Almost every storm door on the street was painted a dull gray, regardless of the color of the house or its trimmings. Our house had rich brown shingles, trimmed with cream, so we made the storm door of tongued and grooved cypress, which has a pretty grain, put in a generous window, and stained the door with a dark-oak oil stain, then finished it with spar varnish. The door was hung with iron T-hinges painted with gold-bronze paint, which gave a pretty effect against the dark-brown stain.

The result was a sturdy storm door which harmonized with the quiet tones of the house, and was not an eyesore. This hint may be useful to other householders who are dissatisfied with the appearance of the front of the house in storm-door time. Mrs. Lydia L. Roberts, Winthrop, Mass.

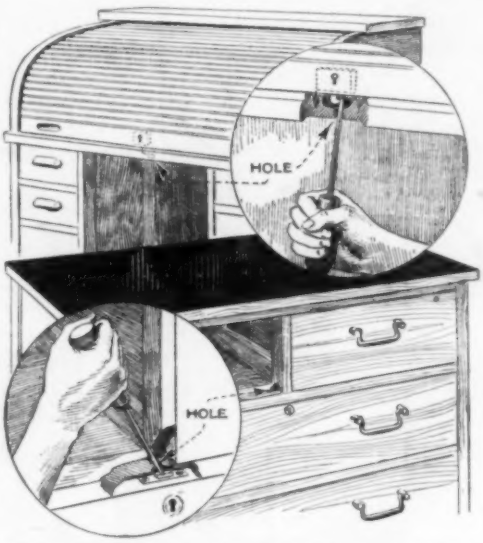
"Long-Distance" Tweezers



Small articles that have fallen into more or less inaccessible places can easily be picked up with the aid of "long-distance" tweezers such as shown in the drawing. This tool is made from an old brass curtain rod and a piece of heavy iron wire. The end of the curtain rod is slotted by means of a hacksaw to form two jaws and the wire is bent at one end to form a loop, which when pulled over the jaws draws them together. The other end of the wire is made to project through a slot cut in the curtain rod, and is bent over so that it can be pulled back with the fingers. The method of using the tool is sufficiently evident from the drawing.

Opening Locked Desks and Drawers

When the key of a desk or drawer has been lost, it is, of course, not desired to mar the finish of the piece of furniture by trying to force it open. In many such cases the simple methods shown in the illustration are applicable. The upper part of the drawing shows how a roll-top desk was opened. A small hole was drilled a little to the side of the catch on the inside, and a pointed tool used to throw the catch open so that the top could be raised. A wooden dowel was then driven into the hole to conceal the opening. The same method was used to open a drawer lock. A small hole was drilled above the lock in this case and a punch or nail used to push the bolt down.



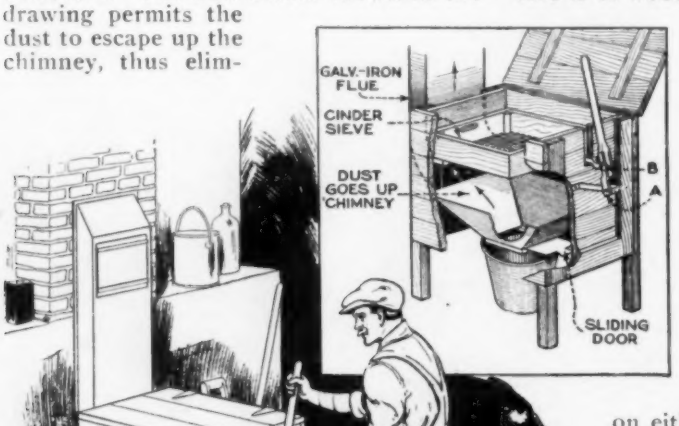
Simple Methods of Opening Locked Desks and Drawers without Injuring Them

Choking Fords in Cold Weather

An adjustable choker of the kind shown in the illustration has been devised for Ford automobiles, and found very satisfactory during cold weather. It can be made by removing the rivet from the original bracket and inserting a stove bolt in its place, with a fiber washer between the arms and the bracket proper. The tension on the bolt forces the choker to remain where set.—R. Metayer, Alexandria, La.

A Homemade Dustless Ash Shaker

One of the greatest conveniences in the home is a dustless ash shaker in the basement. The installation shown in the drawing permits the dust to escape up the chimney, thus eliminating the accumulation of it all over the basement, or even in the rooms above. This ash shaker was made by a practical man and proved entirely satisfactory. It consists of a strong wooden box made of ¾-in. material. Legs of 2 by 2-in. material should be provided to raise the box just high enough to allow an ordinary galvanized-iron pail to be pushed under it, leaving the smallest clearance practicable. Cleats are nailed or screwed to the inside to hold a cinder sieve, which is made of ¾-in. material, about 4 in. wide and covered with ½-in. wire mesh at the bottom. The sieve is about 8 in. shorter than the length of the box. Short pieces of quarter-round molding are nailed at the inside corners, while tin or galvanized iron is nailed around the outside corners, making the sieve strong and durable. Thin slats are nailed to the bottom edges of the sides over the mesh and small roller casters, which can be obtained at any hardware store, are fastened underneath to run on the cleats; these greatly reduce the friction and make the reciprocating movement easy. A slot is cut in the back of the sieve and an arm, which in the present case is of wood, but may be of flat iron, is fastened to the front to engage the handle, which stands vertically and is swung back and forth. A slot must also be cut down in the front of the box, as shown, to allow the arm to extend; this, of course, should be covered after the arm is in place. The handle is a length of 1 by 1-in. wood, rounded at one end to form a comfortable handgrip; two flat-iron strips are screwed or bolted to its lower end on either side, and these are pivoted to a bracket made of the same material and attached to the front end of the box, as shown. The arm on the sieve is similarly pivoted to the handle, and has a slot cut in it to receive the pivot pin. These slots must be long enough to permit the handle to be moved in and out the entire distance without lifting the sieve from the cleats. In the bottom of the shaker a sheet-metal or wooden chute is provided, the sides of which all slant toward the center, where a hole is cut and a sliding door provided underneath. The ashes accumulating in this chute are dropped into a pail by pulling the door open. The ash box should be located near a chimney so that it can be connected to the latter with a galvanized-iron flue, a hole being cut in the back of the ash box to permit the escape of dust up the flue and into the chimney. This hole must be located between the bottom of the cinder sieve and the top of the chute. A sliding door is also provided in the top end of the flue to permit it to be cleaned easily. A tight-fitting wooden cover is hinged to the top of the ash box to prevent dust from escaping.



Homemade Dustless Ash Shaker near the Furnace Separates Ashes and Cinders and Permits Escape of Dust through Chimney

Cleaning Pearls

Pearls can be cleaned by moistening them with alcohol and then drying them in magnesia powder or French chalk, which can be purchased at any drug store and is absolutely harmless. It polishes and cleans colored pearls without bleaching them.

Emergency Auto Radiator

Smashing his radiator while in the middle of the Great Salt Lake desert on a hot summer day put one automobile driver in a bad fix. The motor, of course, would not run very long without water to cool it, and no motorists, from whom help might be expected, were in sight. His car had skidded in loose sand and run against a huge rock, which crushed the radiator. He plugged up all the broken tubes, but it still would not hold water. No one came along and Salt Lake City was about 150 miles away.

A ranch house lay about five miles down the road, and the driver, of course, walked over there in the hope of obtaining help, but found it a tumble-down shack, long deserted. There was a water hole near it, but the only object on the premises that seemed likely to be useful was an old barrel, apparently in good condition. So he decided to take it along even though he had to roll it over the loose sand back to the machine. Then he removed the hood and radiator, and, resting the barrel partly on the bumper and partly on the front cross member of the frame, fastened it with wire, rope and straps, as shown. By means of rubber hose, canvas strips, adhesive tape and old pipe connections, the barrel was hooked up to the engine in the same way as the radiator, and after making several trips to the ranch for water until the barrel was filled above the top hose, he could resume his journey. The hood was stuck into the top of the barrel to prevent the water from splashing out. With this emergency repair, the trip was completed, and the motorist was so pleased with his job that he drove the car all the way to Salt Lake City before he had the radiator properly fixed.—Hal. G. Borland, Carson City, Nev.

Barrel Substituted for Smashed Radiator on Auto Enabled Desert Tourist to Continue Trip

Pocket Golf Tee

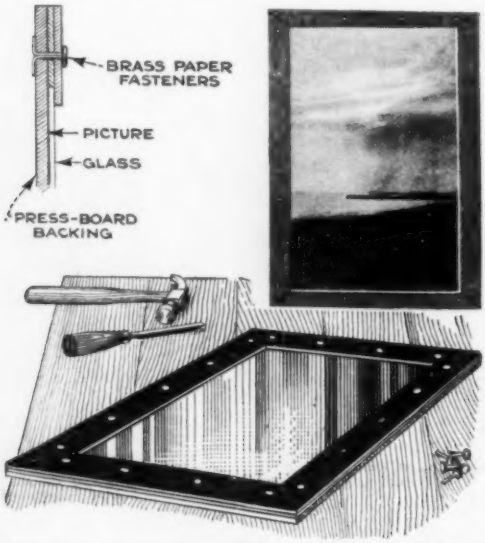
With this simple golf tee, which anybody can make in a few minutes without any special tools, no time is lost in playing the game and by carrying such a tee in the pocket of one's golfing costume, the player is always ready to "tee off," regardless of the nature of the course, and the location of the sand pails. The tee is made from an ordinary spool, cut in half and a short length of garden hose, slipped over it as shown, a small nail being driven through both to keep them together.—J. E. Hoag, Los Angeles, Calif.

Convenient Pocket Golf Tee Made from Spool and Short Piece of Garden Hose

¶When camping, a few pockets sewed to the tent walls at the back end provide a convenient means to hold the soap, mirror, razor and other small articles that are easily lost. The pockets can be made of the same material as the tent and sewed on like a patch.

Cardboard Picture Frames

It often happens that pictures printed on calendars and in magazines are really too good to be thrown away and for this



Neat and Attractive Picture Frames Made of Cardboard at Little Expense

reason many people cut them out and frame them. A new frame for each picture is, however, a rather expensive item. Neat and attractive frames can be made of cardboard, which may be painted and decorated to suit one's fancy. Heavy press board is used as a backing, the picture being attached to it with a little paste dabbed on at the corners. Borders of cardboard, of suitable width and color, are then cut and mitered at a 45° angle, so that when the strips are laid on the edges of the picture, the joints will fit snugly, Several slits are punched through the strips and the backing with a sharp-pointed knife or, better, with a thin ⅛-in. chisel; these holes must be equidistant from each other and also from the edge. To hold the frame and picture together, brass paper fasteners are pushed through the slits and bent over on the back. If desired, a piece of glass or a sheet of thin transparent celluloid may be used to cover the picture to prevent it from being soiled. In case a piece of glass is used, the edges are slipped under the inside edges of the border, and other strips as thick as the glass, are inserted under the outer edges, which are then fastened securely as explained above.

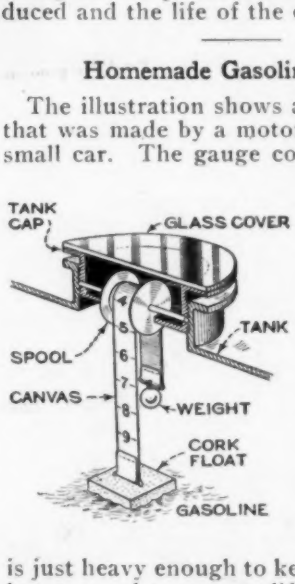
The picture shown in the photo was framed in this way. It was a bromide enlargement, 13 by 20 in. in dimensions. A dark-brown mottled cardboard was used to harmonize with the color of the picture. A pleasing contrast was also produced by using brass fasteners with large heads.—Leslie H. Phinney, Springfield, Mass.

Repairing Old Clocks

When an ordinary clock has served its usefulness and is apparently worn-out, the jeweler's price to overhaul it frequently amounts to almost as much as the original cost. One weak part of a clock is the escapement wheel. The teeth soon wear down, which allows a greater escapement and pendulum movement, and results in an increased strain and wear on the clock. If the tips of the teeth on the wheel are bent up slightly with a pair of pliers, the swing of the pendulum will again be reduced and the life of the clock prolonged.

Homemade Gasoline Gauge

The illustration shows a gasoline gauge that was made by a motorist for use on a small car. The gauge consists of a strip of canvas with the graduations marked on it, rolling over a spool mounted in the cap itself. One end of the strip is attached to a cork float with a staple, and the other to a small weight, which is just heavy enough to keep the strip taut, but not so heavy as to lift the float out of the gasoline. The spool is ½ in. in diameter and ½ in. long, and each end is provided with a wide tin disk to prevent the strip from coming off; the spool is mounted on a wire running through the cap as shown. To prevent evaporation and exclude dust, the top of the cap is covered with a glass disk sealed with shellac.—D. R. Van Horn, Walton, Nebr.



¶"Dead" whetstones can be renewed by burying them in the ground and leaving them there for four to six months; when uncovered, they will be found as porous again as they were when new.

Prize Offers and Announcements

$2,000—Preservative for Cheese

We are packers and distributors of cottage cheese which is sold to the grocery trade in stone jars and sealed paper cups. This cheese spoils rapidly and its maximum life is one week in cool weather; one or two days in hot weather. This makes it impossible for the product to be marketed beyond a local area. We will pay the sum of $2,000 for a method of processing or preserving cottage cheese, satisfactory to us, to keep it sweet and fresh for at least two weeks after packing, regardless of room temperature. Such method must be in accord with all pure-food laws and must not alter the flavor or appearance of the cheese. This treatment might possibly be accomplished by some method of pasteurization and then vacuum packing in individual glass containers. This offer ends May 1, 1925. Address, North Shore Food Products Company, 112 South Morgan Street, Chicago, Illinois.

$500—Automatic Grease Cup

The Carr Fastener Company, manufacturers of the "Dot" high-pressure lubricating system for automobiles and industrial equipment, will pay the sum of $500 for a reservoir grease cup which can be filled through a Dot grease gun, and which will thereafter feed out the grease onto a bearing at a slow and constant rate. There is a tendency in spring-actuated self-feeding grease cups for the grease to feed rapidly when the cup is full, due to the tight compression of the spring, but as the cup empties the spring expands and has less tension and the grease is fed more slowly. If a spring is used, this tendency must be compensated for in some way, or else some principle other than a spring must be devised. All plans or models submitted are to be judged for their value solely by this concern. This offer expires May 1, 1925. Address, Carr Fastener Company, Cambridge, Massachusetts.

$1,000—Detonator for Explosives

This donor, Mr. Frank Lesh, will pay the sum of $1,000 for a method of exploding a gun cap or mercury cap or which will cause a charge to explode under 3,000 feet of water and crude oil, without need of any connecting lines or other similar attachments. The process must not be prohibitive in cost and must do the work without any failures. This concern has a place on which to try out any methods and will act as sole judge as to the worth of any plans offered. It may be that such an arrangement could be brought about by radio. This offer holds good until May 1, 1925. Address Frank Lesh, Box 1700, Casper, Wyoming.

$500—Use for Button Molds

An amount up to $500, depending on the proved value of ideas, will be paid by a concern equipped to make button molds, for new ways of using molds from which buttons formerly were made. Samples of the molds sent on request. Address, Problem HA-1, Popular Mechanics Magazine, Chicago, Illinois.

$500—Uses for Button-Mold Machines

In proportion to the merit of the suggestion, a sum up to $500 will be paid for satisfactory suggestions leading to new uses for the machines employed in manufacturing button molds. Address Problem HA-2, Popular Mechanics Magazine, Chicago, Illinois. The two foregoing offers expire May 1, 1925.

$250—Slogan and Sales Plan

The Casmine Company manufactures and markets a medicinal ointment called "Menthine," which possesses properties for clearing the head and voice and benefiting public speakers and singers, also improves the voices of those afflicted with colds, catarrh, hay fever, etc. This concern desires to adopt a slogan or phrase which will adequately explain the above properties in a very few words and be easily remembered. For a satisfactory slogan or phrase and a plan that will aid in largely increasing our sales to the retail druggists through their jobbers, we will pay the sum of $250. The Casmine Company will alone determine the value of slogans, phrases and plans to their business. May 1, 1925, will be the closing date of this offer. Address Casmine Company, 6 East Twelfth Street, New York City.

$250—Article to Manufacture

The Guyan Machine Shops will pay the sum of $250 to the person submitting to them an article that can be manufactured in their fully equipped machine and electrical shop. Forging and welding departments completely equipped, and brass foundry capable of 100-pound castings are included. The electric division is fitted to make all coils and parts for motors and generators, transformer coils, commutators and allied equipment. We would like an article at least partially developed and prefer that it be something useful in or around coal mines, or that can be sold through jobbing and hardware trade. We would consider parts of mining machines or locomotives or improved attachments for same. Value of articles submitted will be passed upon solely by members of our organization. The award here offered will be in addition to any contract entered into with owner of said article. The offer expires May 1, 1925. Address Guyan Machine Shops, Box 757, Logan, West Virginia.

$50—Snare for Live Fowls

In transferring live chickens from one coop to another, occasionally one or more will escape, making it necessary to be run down and caught, requiring at times considerable effort. We are now using a small wire "V"-shaped hook attached to a long wooden handle which is not very practical. We will pay the sum of $50 for a method accepted by us, or a satisfactory designed hook, which will enable a person easily to catch the fowl around the legs or otherwise. Address Security Produce Company, 209 West South Water Street, Chicago, Illinois.

$50—Profitable Uses for Eggshells

In our egg-breaking plant where several cars of eggs are broken each day for canning purposes, there is a large by-product of eggshells. While these have been used heretofore for chicken feed, we will pay the sum of $50 for a satisfactory plan, process or method of otherwise profitably disposing of these eggshells. All entries for both the offers are to be judged by this concern alone, and the date of closing for each is May 1, 1925. Address Security Produce Company, 209 West South Water Street, Chicago, Illinois.

$25—Substitute for Nickel Plating

The Duplex Timer Manufacturing Company will pay the sum of $25.00 for a satisfactory substitute for nickel plating Ford roller timers. We believe that there should be a suitable lacquer, enamel or metallic dip of white or some bright color which will add individuality to the appearance of the timer, and eliminate the expense of nickel. It must be remembered that the timer roller has a grooved contact surface, and any lacquer or dip that is used will have to be applied thin enough to allow the flow of electric current when contact is made with the timer raceway. For a substitute that meets these requirements and proves satisfactory the award will be paid. Address Duplex Timer Manufacturing Company, 1927 East Lynn Street, Seattle, Washington.

OFFERS ANNOUNCED IN PREVIOUS ISSUES

All of These Offers Expire May 1, 1925

FOR AN INK THAT WILL PRINT CLEARLY and can be erased from tracing cloth without marring the surface, $100 in cash, or as payment toward patent, will be paid. Address Problem NA-1.

ROYALTIES OF $5,000 WILL BE PAID within the first year for method of animated drawings by which yachts and boats can be illustrated to prospective purchasers. Problem NA-1.

FOR THE BEST LIST OF SALIENT AND glaring faults now found in practice in large drafting rooms with their remedies, $100 will be paid by donor of Problem NA-1.

THE NATIONAL COMPANY, INC., OFFER $10,000 in percentages from sales for a new radio static or interference eliminator.

$10,000 IN RETURNS FROM SALES IS ALSO offered by the National Company for a highly efficient fixed radio condenser of small size and large capacity.

A PIECE OF NEW MERCHANDISE THAT could be sold through optical, photographic and sporting goods stores is desired by Wollensak Optical Co., who will pay royalties of $5,000 for accepted article.

FOR PROCESS OF MAKING HARD-GLOSSED candies without impairing their appearance or quality the Happiness Candy Stores, Inc., will pay the sum of $1,000.

$1,000 WILL BE PAID BY THE HAPPINESS Candy Stores, Inc., for a method of manufacturing chocolate coating which will not turn gray or dull when exposed to atmospheric conditions.

CONTINENTAL CAR COMPANY OFFERS $5,000 in royalties for hoist for dump bodies operated by motor vehicle from driver's seat with power from engine; $1,000 under like arrangement for new toy or article of household furniture to be made from lumber scraps of truck bodies. Also $5,000 in royalty arrangement for air-dumping device to be controlled from locomotive by engineer.

$1,000 IS OFFERED BY KIRSTIN COMPANY for improvements in Fil-Gage and reductions in cost of manufacture and distribution amounting to twenty per cent.

FOR A NEW METHOD WHEREBY SCRAP leather in a glove factory can be profitably disposed of, Eisendrath Glove Company will pay sum of $5,000.

NATIONAL SLATE ASSOCIATION WILL pay $200 for best suggested new use for slate; other accepted suggestions paid for in proportion to value.

WILLIAM H. MITCHELL COMPANY WILL pay $500 for three new uses suggested for low-voltage generators which they adopt as part of sales plan.

FOR AN ANTI-FREEZING INGREDIENT FOR an emulsified asphaltic concrete S. D. Hofheimer will pay the sum of $500.

GRANITE STATE MOWING MACHINE COMpany offers $500 in cash and royalties for satisfactory working drawings for gasoline-motor lawn mower they accept for manufacture and marketing.

NATIONAL BRASS COMPANY WILL PAY $300 for design of key guide that can be made of sheet metal and which will properly fit escutcheon plate of similar material.

IN FOUR AWARDS OF $500, $250, $150 AND $100, the South Bend Lathe Company offers payment for four best ideas for new and practicable attachments for screw-cutting engine lathe.

FOR A PRACTICAL INEXPENSIVE MEANS by which carbonization can be prevented in portable oil burners of vaporizing type, Aeroil Burner Company will pay $500.

THE YELLOW CAB MANUFACTURING company offers an award of $50,000 for a perfected plan of traffic and pedestrian correction and regulation, including mechanical devices, regulations, etc., for the promotion of greater street safety.

$10,000 FOR A NEW MUSICAL INSTRUMENT which can be incorporated in any orchestra or brass band and will take a place among the present family of musical instruments accepted by the rank of players. Lyon & Healy, Inc.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

$100 FOR PLAN OF PROFITABLY DISPOSing of chamois skin scraps. Bassick Manufacturing Company.

DISCOVERY OF NEW USES FOR CARBONdioxide gas or improvements to present uses. Award $1,000.

FOR AN AUTOMATIC FREEZEPROOF SODA cooler adaptable to "iceless" type of soda fountains, $1,000. Above two problems by Liquid Carbonic Company.

$2,000 WILL BE PAID IN SEVERAL AWARDS for processes and machines for salvaging waste lumber. National Lumber Manufacturers' Association.

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

$500 FOR SALES PROMOTION PLAN FOR absorbent, non-heat-conducting powder that can be used with other materials. The Keasby and Mattison Company.

ROYALTIES OF $15,000 WILL BE PAID BY the Aetna Industries, Incorporated, for improvements in their products or new articles they accept for manufacture and sales.

THE GEMCO MANUFACTURING COMPANY will pay $250 for suitable article they can make in their general metal-working plant.

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and branding iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

$200 WILL BE PAID BY THE ABOVE CONcern for the best suggested new use for the device named in the next preceding. Other cash awards in proportion.

PROCESS BY WHICH ZINC THAT OXIDIZES and is lost in brass foundries can be saved and used. Award $500.

PLAN BY WHICH LEATHER WASTED IN making of belting, etc., can be disposed of at profit to manufacturer. Award $100.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

Additional Offers Will Appear in the DECEMBER ISSUE